

1. Work requester fills out this section.

☐ Standing Work Permit

Requester: Don Lynch	Date: 07/01/2009	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 07/06/20098	Est. End Date: 12/1/2009
Brief Description of Work: Install RPC3 N Detector subsystem array			
Building: 1008	Room: IR & Tunnel North of IR	Equipment: RPC3 N	Service Provider: PHENIX techs & RPC experts, riggers,carpenters, electricians, masons, CAD Techs

. WCC, Requester/Designee, Service Provider, and ES&H (as necessary) fill out this section or attach analysis

ES&H ANALYSIS				
Radiation Concerns	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne	<input type="checkbox"/> Contamination <input checked="" type="checkbox"/> Radiation
Radiation Generating Devices:	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges	<input type="checkbox"/> X-ray Equipment
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group			<input type="checkbox"/> Fissionable materials involved, notify Laboratory Criticality Officer	
Safety Concerns	<input checked="" type="checkbox"/> None	<input checked="" type="checkbox"/> Ergonomics	<input type="checkbox"/> Transport of Haz/Rad Material	
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input checked="" type="checkbox"/> Confined Space*	<input type="checkbox"/> Explosives	<input type="checkbox"/> Lead*	<input type="checkbox"/> Penetrating Fire Walls
	<input type="checkbox"/> Corrosive	<input type="checkbox"/> Flammable	<input type="checkbox"/> Magnetic Field*	<input type="checkbox"/> Pressurized Systems
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Fumes/Mist/Dust*	<input checked="" type="checkbox"/> Material Handling	<input type="checkbox"/> Rigging/Critical Lift
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Noise*	<input type="checkbox"/> Toxic Materials*
<input type="checkbox"/> Biohazard*	<input checked="" type="checkbox"/> Elevated Work*	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Non-ionizing Radiation*	<input type="checkbox"/> Vacuum
<input type="checkbox"/> Chemicals*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Oxygen Deficiency*	<input type="checkbox"/> Other
* Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Environmental Concerns		<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.	
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input type="checkbox"/> Land Use	<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed	
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Liquid Discharges	<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive	
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Oil/PCB Management	<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical	
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Spill potential	<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping	
Waste disposition by:			<input type="checkbox"/> Other	
Pollution Prevention (P2)/Waste Minimization Opportunity:		<input checked="" type="checkbox"/> None <input type="checkbox"/> Yes		
FACILITY CONCERNS		<input checked="" type="checkbox"/> None		
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise	<input type="checkbox"/> Potential to Cause a False Alarm	<input type="checkbox"/> Vibrations	
	<input type="checkbox"/> Impacts Facility Use Agreement	<input type="checkbox"/> Temperature Change	<input type="checkbox"/> Other	
<input type="checkbox"/> Configuration Control	<input type="checkbox"/> Maintenance Work on Ventilation Systems	<input type="checkbox"/> Utility Interruptions		
WORK CONTROLS				
Work Practices				
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input checked="" type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment	<input type="checkbox"/> Security (see Instruction Sheet)
<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation	<input type="checkbox"/> Other
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")	
Protective Equipment				
<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input type="checkbox"/> Gloves	<input type="checkbox"/> Lab Coat	<input checked="" type="checkbox"/> Safety Glasses
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator	<input checked="" type="checkbox"/> Safety Harness
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input checked="" type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers	<input checked="" type="checkbox"/> Safety Shoes <input type="checkbox"/> Other
Permits Required (Permits must be valid when job is scheduled.)				
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems		
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No		
<input checked="" type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other		
Dosimetry/Monitoring				
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input checked="" type="checkbox"/> TLD	
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization	
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O ₂ /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input checked="" type="checkbox"/> Other Check O2 level prior to entry	
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump		
Training Requirements (List below specific training requirements)				
Confined Space, CA –Collider User, PHENIX Awareness				
Based on analysis above, the Walkdown Team determines the risk, complexity, and coordination ratings below:			If using the permit when all hazard ratings are low, only the following need to sign: (Although allowed, there is no need to use back of form)	
ES&H Risk Level:	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High	WCC: _____ Date: _____
Complexity Level:	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High	Service Provider: _____ Date: _____
Work Coordination:	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High	Authorization to start _____ Date: _____
(Departmental Sup/WCC/Designee)				

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

Work Plan (procedures, timing, equipment, and personnel availability need to be addressed): This project has been extensively reviewed with all service providers to assure optimum coordination in schedule and responsibilities. A detailed installation plan has been created and reviewed. A copy is attached.				
Special Working Conditions Required: None				
Operational Limits Imposed: Modification work limited to lower octants easily reachable when standing on lower magnet superstructure.				
Post Work Testing Required: No				
Job Safety Analysis Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Walkdown Required: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Reviewed by: Primary Reviewer will determine the size of the review team and the other signatures required based on hazards and job complexity. Primary Reviewer signature means that the hazards and risks that could impact ES&H have been identified and will be controlled according to BNL requirements.				
Title	Name (print)	Signature	Life #	Date
Primary Reviewer				
ES&H Professional				
Other				
Other				
Work Control Coordinator				
Service Provider				
Review Done: <input type="checkbox"/> in series		<input type="checkbox"/> team		

4. Job site personnel fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments).			
Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:
Workers are encouraged to provide feedback on ES&H concerns or on ideas for improved job work flow. Use feedback form or space below.			

5. Departmental Job Supervisor, Work Control Coordinator/Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)			
Name:	Signature:	Life#:	Date:

6. Departmental Job Supervisor, Work Requester/Designee determines if Post Job Review is required. ☐ Yes ☐ No

Post Job Review (Fill in names of reviewers)			
Name:	Signature:	Life#:	Date:
Name:	Signature:	Life#:	Date:

7. Worker provides feedback.

Worker Feedback (use attached sheets as necessary) a) WCM/WCC: Is any feedback required? <input type="checkbox"/> Yes <input type="checkbox"/> No b) Workers: Are there better methods or safer ways to perform this job in the future? <input type="checkbox"/> Yes <input type="checkbox"/> No
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8. Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of work area to work supervisor)

Name:	Signature:	Life#:	Date:
Comments:			

Installation of the RPC3 Detector Subsystem in the PHENIX North Tunnel

Introduction

In the 2009 shutdown, the PHENIX experiment plans to install the first station of the new RPC detector subassembly. This detector will be an integral part of a new fast muon trigger for the PHENIX experiment that will enable the study of flavor separated quark and anti-quark spin polarizations in the proton. A powerful way of measuring these polarizations is via single spin asymmetries for W boson production in polarized proton-proton reactions. The measurement is done by tagging W^+ and W^- via their decay into high transverse momentum leptons in the forward directions. The PHENIX experiment is capable of measuring high momentum muons at forward rapidity, but the current online trigger does not have sufficient rejection to sample the rare leptons from W decay at the highest luminosities at the Relativistic Heavy Ion Collider (RHIC). Installation of the North station 3 component of the RPC detector subsystem in conjunction with the installation of the Muon Trigger FEE stations 1, 2 and 3 which was completed last year will be a major milestone in the overall project.

The installation of RPC station 3 north is accomplished by installing each of 16 half-octants of the full detector station which surrounds the RHIC accelerator beam axis in a 360° coverage. Each half-octant is a 4 sided truncated wedge/pie shape approximately 12 feet long, approximately 2 feet wide at the narrow end and approximately 7 feet wide at the outer end. The maximum thickness of the half octant is 4.76 inches. The half octants will weigh a maximum of 750lbs each.

Installation of the half octants is accomplished using a detailed procedure, described herein, involving the use of a portable crane and 2 custom designed lifting assemblies, each of which has 3 different lifting points to be used to lift and orient the half octants into their installed positions. The design calculations for the lifting fixtures are documented in PHENIX analysis document DRL-ECD-2009-008, wherein the design calculations to demonstrate the structural integrity of both of these lifting fixtures under the design conditions is described.

The procedure by which this installation will be accomplished is provided below. An Illustrated installation plan, which has been reviewed by CAD ESRC personnel and CAD engineers is attached.

Work Plan

This work is to be done by fully trained and experienced personnel (PHENIX and CAD mechanical and electrical technicians, BNL riggers, BNL Masons and BNL electricians during the 2009 summer shutdown.

1. Preparation for Installation

a) Gap evaluation/Cleaning Review with Masons for grouting

PHENIX engineers and technicians shall meet with BNL Masons to evaluate the task of pouring grout into gap 5 to achieve maximal structural support for the east and west base support assemblies. A mockup of the gap shall be constructed at the RPC factory and test pours will be made to optimize grout properties for flow and stability. BNL carpenters shall build appropriate forms for the mockup test. A written description of the optimal grouting procedure shall be generated and attached to the work permit.

b) Disassemble and remove shielding & crystal palace

Under direction of CAD engineering, CAD technicians, BNL riggers and BNL carpenters shall disassemble and remove large shielding blocks in the PHENIX north tunnel area which would otherwise impede access to the gap 5 area by the BNL walk behind crane. In addition, the so-called crystal palace north, and the gap 5 vapor barrier shall be disassembled and removed.

c) PHENIX technicians shall disconnect the MuID gas panel and other equipment from MuID gap 5 steel and relocate away from gap 5.

d) BNL electricians and PHENIX technicians shall isolate, label, disconnect, and remove cable and piping from gap 5 including any cable tray and piping attached to MuID gap 5 steel. All cables, cable tray etc. on the east side of central pedestal (i.e. the FCAL cables) and any related infrastructure (i.e. the cable protection walkover for the FCAL cables) shall be isolated, labeled, disconnected, and removed for the duration of the installation process.

e) The trench which comprises gap 5 shall be cleaned of all debris and vacuumed to prepare for the grout pour.

f) Lifting fixtures shall be designed by PHENIX engineering, calculations reviewed by the BNL Lifting Safety Committee (LSC) and verified by test (at the Factory) by the LSC.

g) All lifts, half octant manipulations and coordination between PHENIX technicians and BNL riggers shall be practiced using a mockup of gap 5, actual lifting fixtures and the actual walk behind crane to be used for the lifts, and a dummy $\frac{1}{2}$ octant made up of actual structural parts (but no internal electronics).

h) All $\frac{1}{2}$ -octants shall be pre-surveyed at the factory to establish appropriate external references to facilitate precise installation. All $\frac{1}{2}$ -octants shall be marked with a unique designation indicating its final installed position (i.e. 1E through 8E and

1W through 8W in accordance with the illustrated installation plan, attached to this work permit).

- i) A pattern of tapped holes on the MuID steel wall adjacent to gap 5 shall be located and marked by BNL surveyors, then drilled and tapped by PHENIX technicians in accordance with the attached illustrated installation plan and PHENIX drawing number 105-0224-044 rev A.
- j) BNL electricians shall repair, replace and or augment lighting in the PHENIX north tunnel as appropriate to adequately illuminate the area for the work described herein.
- k) Manlifts and the BNL walk behind crane shall be pre-positioned in the PHENIX north tunnel as appropriate to commence installation.
- l) All ½-octants shall be pre-tested in the RPC3 burn-in test stand for a period of time as deemed appropriate by the RPC3 group experts prior to commencing installation.
- m) All procedures and this work permit shall be appropriately reviewed, acknowledged and understood by all PHENIX, RPC, BNL trades and CAD personnel involved in the tasks described herein, prior to commencing installation.

2. Mechanical Installation Procedure

- a) BNL Masons shall lay a base level of grout in accordance with the procedure developed in step 1 (a), above. (Note: should it be determined in step 1 (a), above, that the grouting should be accomplished in a single step after the support base (east and west) has been leveled, surveyed and installed, then this step shall be eliminated.)
- b) Pitch control hardware (unistrut support tracks) shall be installed as illustrated in the attached plan and detailed in PHENIX drawing # 105-0224-001 rev A, attached.
- c) Support base installation
 - i. The east and west support bases shall be assembled and installed as illustrated in the attached plan and detailed in PHENIX drawings # 105-0224-010 rev A and 105-0224-001 rev A, respectively, attached.
 - ii. The final grout layer shall be poured and allowed to cure in accordance with the procedure developed in step 1 (a),

above.

- d) Install the 16 $\frac{1}{2}$ -octant detector subassemblies as illustrated in the attached plan and detailed in PHENIX drawing #105-0224-001 rev A, attached. The $\frac{1}{2}$ octants are designated and marked according to their intended location within the full station 3 North subsystem (i.e. 1E through 8E and 1W through 8W. The order of installation will be as follows: 1W, 2W, 3W, 4W, 1E, 2E, 3E, 4E, 8W, 7W, 8E, 7E, 5W, 6W, 5E and 6E. For each $\frac{1}{2}$ -octant the procedure will follow the general steps as follows:
 - i. Load the $\frac{1}{2}$ -octant onto the transport cart at the RPC factory in accordance with its destination location as identified on its case and illustrated in the attached plan.
 - ii. BNL riggers will move the $\frac{1}{2}$ -octant on the cart from the RPC factory to the PHENIX north tunnel
 - iii. Move the cart into the north tunnel and roll it south on the east side of the pedestal to about 2 feet from the MuID steel.
 - iv. Move the walk-behind crane close and attach the hoist and $\frac{1}{2}$ -octant lifting fixture to the appropriate lift position (see illustrations in attached plan).
 - v. Lift the $\frac{1}{2}$ -octant to its staging position (over the DX magnet for the west $\frac{1}{2}$ octants)
 - vi. (For $\frac{1}{2}$ -octants requiring a lifting reposition, place the $\frac{1}{2}$ -octant in its reposition berth (see illustrations in attached plan), and reposition crane and lifting points as indicated.
 - vii. Lift $\frac{1}{2}$ -octant to its final installed position and secure it as illustrated in the attached plan and detailed in PHENIX drawing #105-0224-001 rev A, attached.
 - viii. Attach gas and electronics connections as required for minimal non-operational support.
- e) When all $\frac{1}{2}$ -octants have been installed. Move the sliding base support assemblies to their "0"-position and make adjustments to upper adjusting screws to align all $\frac{1}{2}$ -octants to each other and existing survey holes/marks.
- f) Survey to record installed positions of all $\frac{1}{2}$ -octants.

3. Electrical and gas connections

The RPC3 North electrical and mixed gas utility support plans have been reviewed by the CAD ESRC and found to be in compliance with all relevant BNL, CAD and PHENIX general requirements. Power and electrical infrastructure (cable trays and power cables) will be installed by BNL electricians in compliance with all applicable codes and regulations. Electrical signal, electronic control, safety and gas system components shall be installed by qualified PHENIX technicians and/or RPC system experts. The following general steps will be carried out in order:

- a) Install gas supply racks and monitoring in PHENIX gas mixing house.
- b) Install cable and gas line management support.
- c) Install gas supply and return lines from mixing house to PHENIX tunnel north.
- d) Install gas distribution panel/rack and bubbler(s) at PHENIX tunnel north
- e) Install supply and return lines from gas distribution panel to individual $\frac{1}{2}$ -octants.
- f) Install rack room controls and electronics in support of RPC3 North in the PHENIX rack room.
- g) Install 2 full size detector electronics racks in west trough of PHENIX tunnel north.
- h) Install power to RPC3 north racks.
- i) Install RPC3 north electronics equipment in the 2 racks.
- j) Install LV and signal cables in cable trays.
- k) Install communications links to rack room electronics

After all gas system, electrical, electronic and safety system components have been installed such systems shall be commissioned by a series of tests to affirm proper operation of all components and integration of the detector subsystem into the overall PHENIX experiment and data acquisition (DAQ) system.

4. Restoration of displaced equipment, services and infrastructure

After installation is completed, accelerator infrastructure, shielding and equipment removed for RPC3 North installation access shall be restored/replaced as follows:

- a) BNL electricians and PHENIX technicians shall install new support infrastructure to support restore MuID cable and piping in gap 5 and cables, cable tray etc. on the east side of central pedestal (i.e. the FCAL cables) and any related infrastructure (i.e. the cable protection walkover for the FCAL cables) shall be reinstalled in its original form or functional equivalent.
- b) Remove manlift, crane and any other construction equipment from the area near gap 5
- c) Construct the new thermal/vapor barrier in accordance with PHENIX thermal vapor barrier plan dated June 30, 2009 as supplied to CAD engineering July 1, 2009.

(Note: This task will be performed under direction of CAD engineering, wherein CAD technicians, BNL riggers and BNL carpenters shall design and construct the thermal vapor barrier. Additional documentation of this task may be generated by CAD personnel.)

- d) BNL riggers shall reinstall the large shielding removed as described step 1 (b) of this document.
- e) Manlifts and the BNL walk behind crane shall be removed from the PHENIX north tunnel as.

5. Work conclusion

When all work described in this work permit has been completed, the PHENIX work coordinator for this set of tasks shall collect feedback from all parties (BNL trade groups, CAD engineers and technicians, PHENIX engineers and technicians and RPC experts). This feedback shall include critical review of any problems encountered during installation, solutions to such problems, changes to work procedures described herein during the conduct of this work, suggestions for improvements in equipment procedures and techniques and any other information deemed useful and/or relevant by the PHENIX work control coordinator. Such information shall be appropriately disseminated to the various affected/interested parties and a copy of this information shall be attached to this work permit when it is closed out.

(Note: During the summer of 2010, the lessons learned from the tasks described herein shall be applied to the nearly identical tasks required to install the next phase of the RPC detector project, the RPC3 South detector subsystem.)

RPC3 North Detector Installation

RPC3 North Detector Installation Plan

June 25, 2009

RPC3 North Detector Installation

Plan Outline

1. Prep for Installation
 - a) Gap evaluation/Cleaning Review with Masons for grouting
 - b) Disassemble and remove shielding & crystal palace
 - c) Disconnect gas panel and other equipment from MuID gap 5 steel and relocate away from gap 5
 - d) Isolate, label, disconnect, and remove cable and piping from gap 5 including any cable tray and piping attached to MuID gap 5 steel
 - e) Clean gap 5
2. Alignment and survey
3. Installation plan
 - a) Preliminary work and practice at RPC factory
 - b) Gap 5 1st (rough) grout layer
 - c) Pitch control hardware installation
 - d) Gap 5 MuID steel prep
 - e) Support base installation
 - i. Install, survey and level east and west bases
 - ii. Final grout layer
 - f) Detailed installation procedure
4. Electronics and gas system installation
5. Commissioning
6. Schedule

RPC3 North Detector Installation

1. Prep for Installation
 - a) Gap 5 North Evaluation

RPC3 North Detector Installation

IR, northeast corner by gap 5

A look at
the floor
in gap 5 at
the vapor
barrier



Gap 5 Northeast,
cable tray a few
cables and 2
pipes interfering
with space



RPC3 North Detector Installation

IR, northwest along gap 5



Cable trays and pipes in gap 5 north

Mostly clear floor in gap 5 north. Like gap 5 south, is not uniform/flat



RPC3 North Detector Installation

North East corner
of IR. This is most
accessible corner
30+" of clearance



Some assistance in the installation
will need to be provided by a tech
in the corners of the IR. As can
be seen in these photos there is
not much room in these areas.



North West
corner of IR
~28" in clearance
but cable trays
and piping need
to be dealt with
first

RPC3 North Detector Installation

Some potential problems
from the top of gap 5



IR Crane support directly
above beam centerline ~ 4
in above gap 5 steel



IR Crane supports ~7 ft east
and west of centerline gusset
with hole may interfere with
installation of half-octants

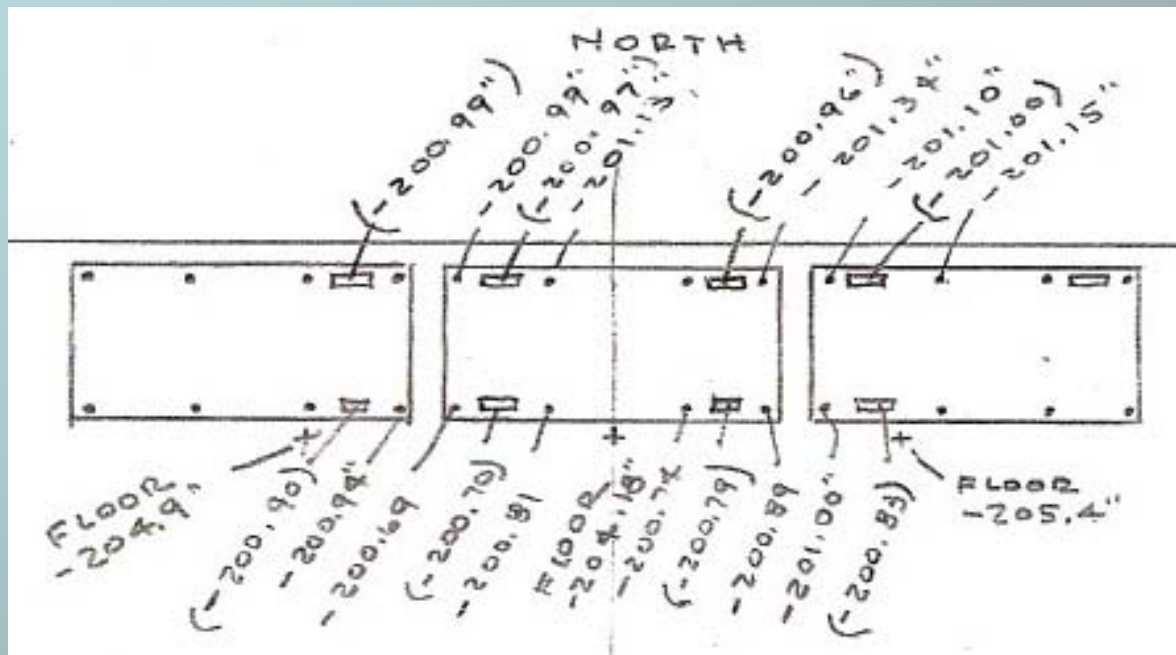
Gap 5 steel is 3 pcs
which are not in
plane ~ $\frac{1}{2}$ inch at top
may vary along entire
length

RPC3 North Detector Installation

west

Survey points along floor, on top of 2" steel block and on top of bolt-nut combination.

Survey done by Frank Karl 4/14/2008.

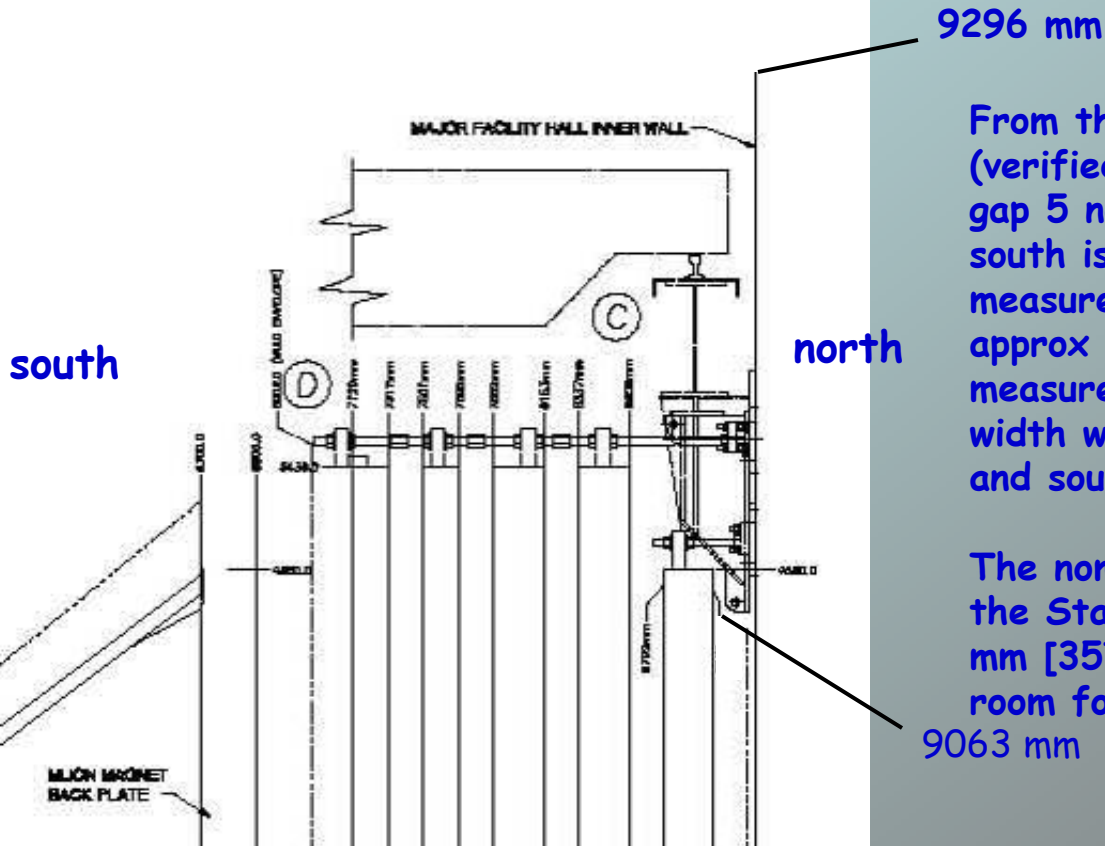


east

south

To accommodate all variation we will assume we can establish a grouted level flat surface at Approximately 200 inches below reference beam height. All mechanical base supports and adjustments must fit between this surface and the bottom face of the lower half octants which are calculated nominally at 194.39 inches below the reference beam height. Survey results are consistent with PHENIX envelope model. (Note: 200.25 +/- 0.125" below the nominal beam height has been established as the target reference for the bottom surface of the base support.)

RPC3 North Detector Installation



From the PHENIX control drawing (verified by survey) the minimum width of gap 5 north is 206 mm [9.17 in] (note: south is same) actual recent measurements indicate that this width is approx 10 in (10.75 on south) where measured. To be conservative the design width will be taken to be 9 inches north and south.

The nominal position of the IR side of the Station 3 RPC's shall be set at 9080 mm [357.5 in] from the IP. This will allow room for adjustments in gap.

RPC3 North Detector Installation

Gap 5 space utilization:

356.8-357.5 (.7") z- adjustment space

357.5 - 362.3 (4.8") Detector space

362.3 - 362.6 (.5") z- adjustment space

362.6 - 365.8+ (3+") piping & cable tray space

Using 9" as our minimum gap 5 width, we will have a minimum of 6" clearance in the gap for half octant installation

RPC3 North Detector Installation

1. Prep for Installation

- b. Disassemble and remove shielding, side and top vapor barrier & crystal palace to clear a minimum 50" wide path from loading dock to gap 5 on east sides of beam pipe and all items in both east and west trenches within 15 feet of gap 5

RPC3 North Detector Installation



Vapor Barrier to be removed prior to commencing RPC installation.

Barrier to be replaced by new thermal insulating wall attached to the existing imbedded unistrut. 80" from MuID steel.

Crystal Palace needs to be completely removed for installation, modified and reinstalled for run 10



RPC3 North Detector Installation

Tunnel northwest side



All large shielding blocks to be relocated to allow access



RPC3 North Detector Installation

1. Prep for Installation
 - c. Disconnect gas panel and other equipment from MuID gap 5 steel and relocate away from gap 5

RPC3 North Detector Installation

MuID gas flow control panel to be dismounted from Gap5 steel and remounted to new unistrut stand on pedestal floor



RPC3 North Detector Installation

1. Prep for Installation

d. Isolate, label, disconnect, and remove cable and piping from gap 5 including any cable tray and piping attached to MuID gap 5 steel, physically in the gap 5 space and/or attached to the tunnel walls or pedestal within 3 feet of gap 5. Place removed piping, cables and cable supports in a safe place in the tunnel until ready for re-installation.

RPC3 North Detector Installation

Tunnel northeast side

Tray with a few cables and a couple of pipes that will need to be moved



Some basket tray and a few cables that will need to be moved



Single person aerial lift to be placed here for installation of north east 8 half octants

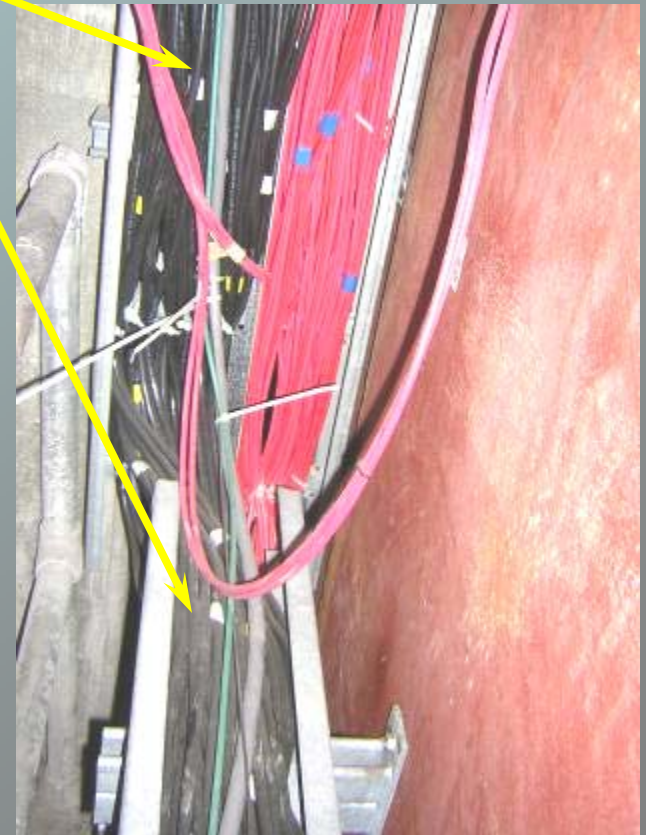
RPC3 North Detector Installation

Tunnel northwest side



Two new racks to be installed here
on west side of north pedestal

Cable trays on north west interfere
with gap 5 north. These trays are
full.



RPC3 North Detector Installation

IR, northwest along gap 5



Cable tray and pipes in Gap 5 northwest going into tunnel

Tunnel side, northeast along gap 5



Cable tray with only a few cables and 2 pipes below it

RPC3 North Detector Installation

Tunnel northwest side



RPC3 North Detector Installation

1. Prep for Installation

- e. Final cleaning Gap 5 North to prep for base installation and grouting

RPC3 North Detector Installation



RPC3 North Detector Installation

2. Alignment and Survey

RPC3 North Detector Installation

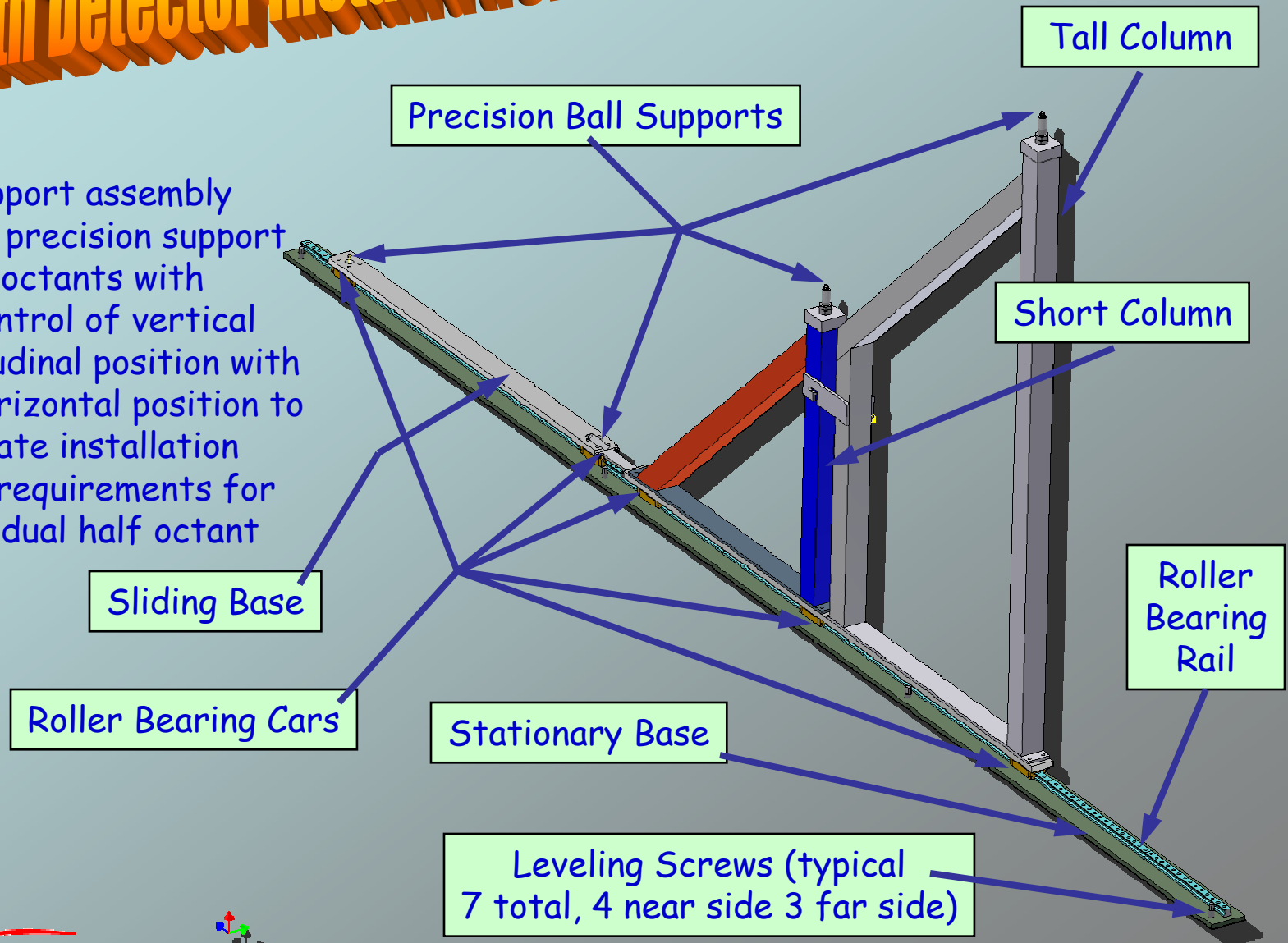
Base support

- Guide rollers, rails, 2 columns
- 60" travel of base support
- single point socket mounts,
- east and west rail plates align vertically and longitudinally, $\frac{1}{2}$ " gap transversely
- transverse alignment on rails with survey fixture to simulate half octant motions
- 7 screw baseplate adjustment on east and west baseplates
- Align east and west rail plates in all directions then grout in place
- Install unistrut railways on east and west side of pedestal to guide buildup of half octants to half station
- Additional in-plane support/adjustment needed at midline and at top

RPC3 North Detector Installation

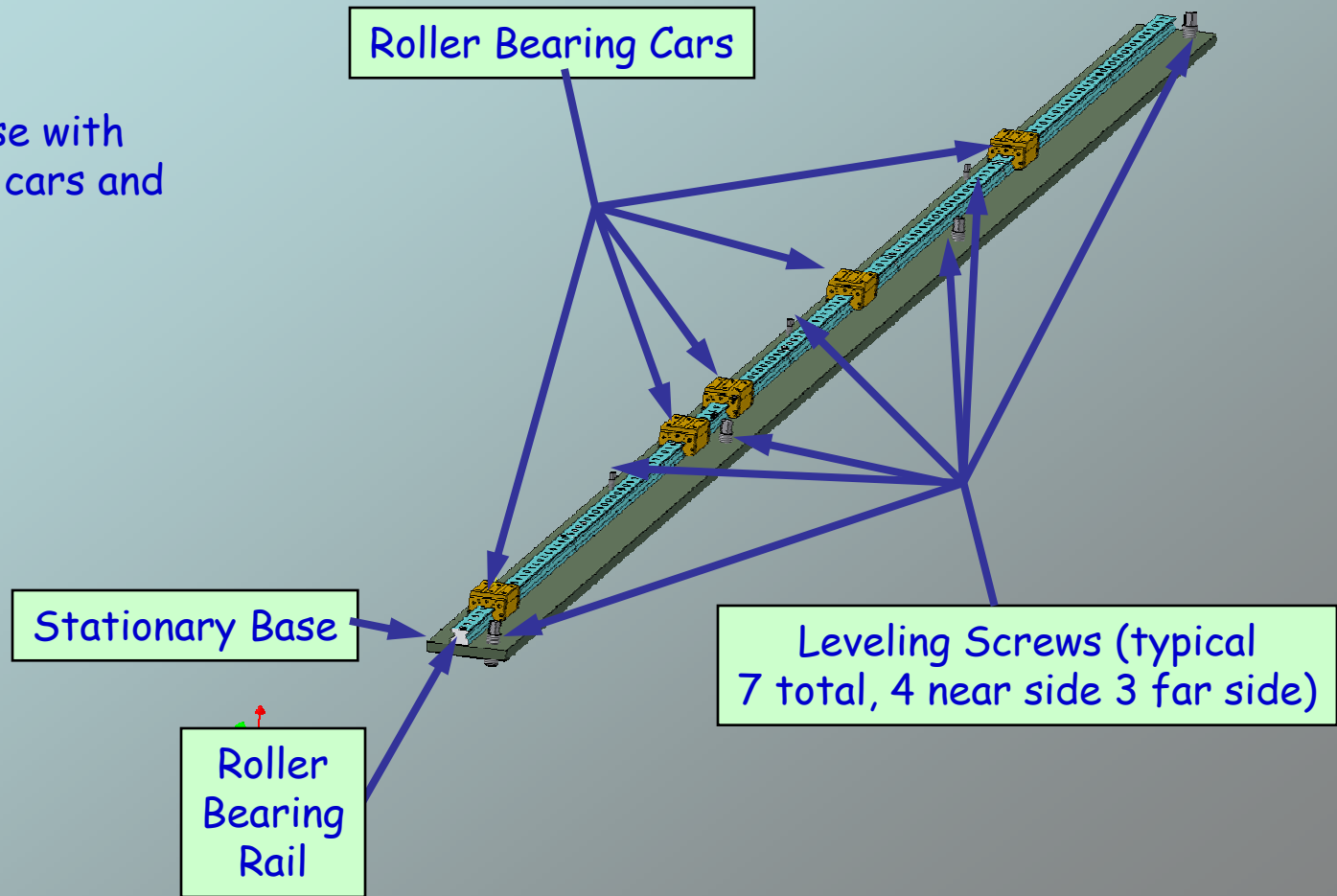
Sliding Half Station Support Assembly

Sliding support assembly provides a precision support for 8 half octants with precise control of vertical and longitudinal position with varying horizontal position to accommodate installation clearance requirements for each individual half octant

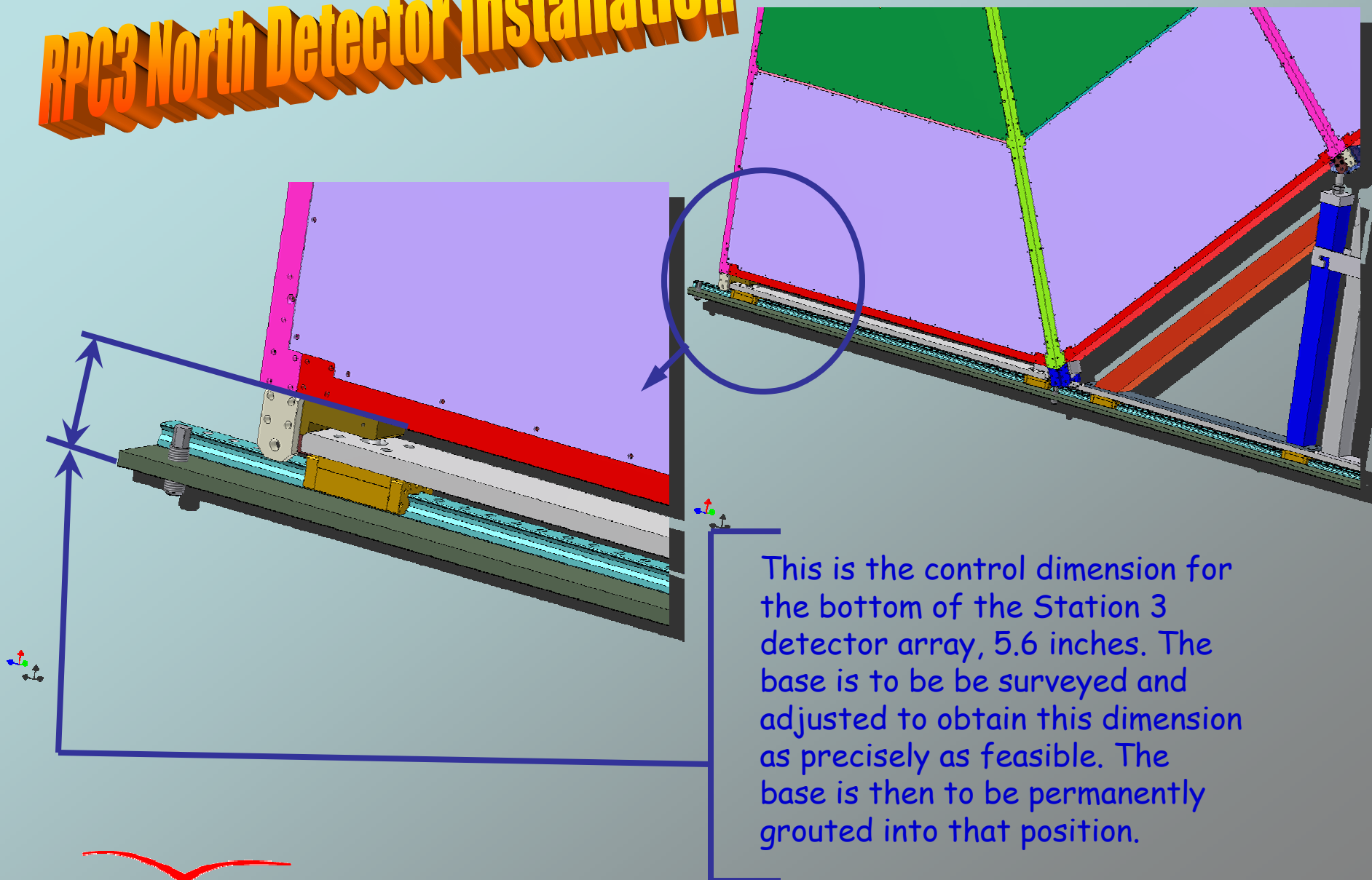


RPC3 North Detector Installation

Stationary Base with
Roller Bearing cars and
rails.



RPC3 North Detector Installation

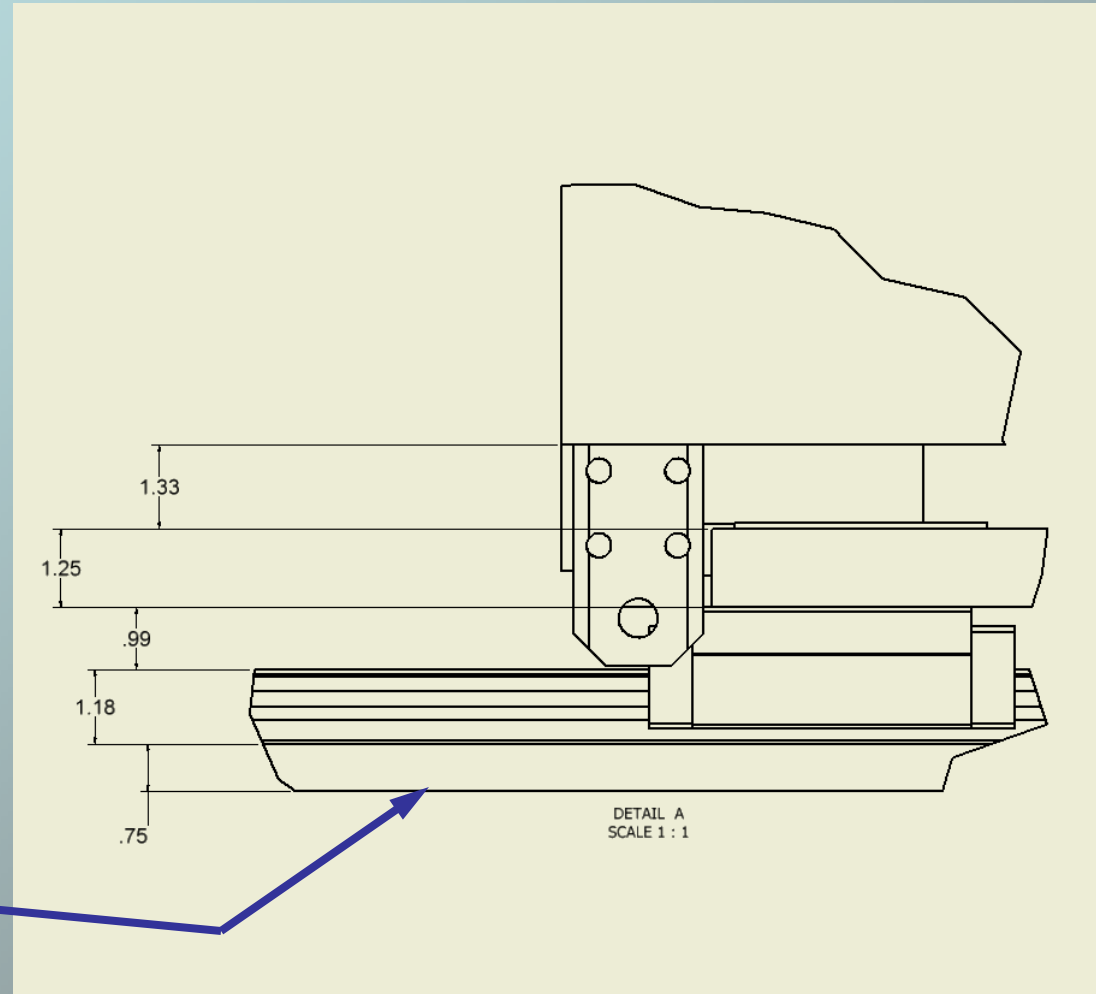


RPC3 North Detector Installation

This distance is 5.6" maximum
Possible stackup:

- .75" baseplate
- + 1.18" rail
- + .99"(above rail) pillow block
- + 1.25" carriage plate
- + .75 to 1.08" mounting balls
- + .25" Ball Pad
- /- 0 to .33" adjustment
- = 5.6"

Grouted level underside
of fixed baseplate at
200 Inches below
nominal beam height



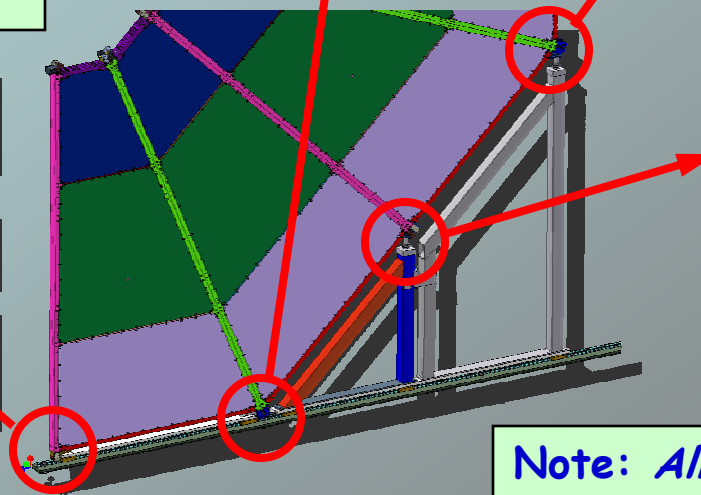
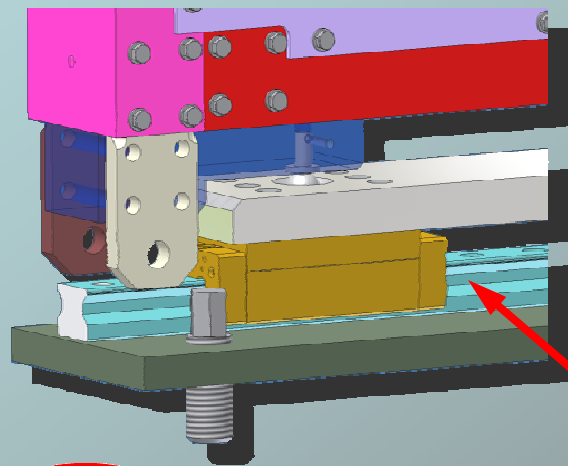
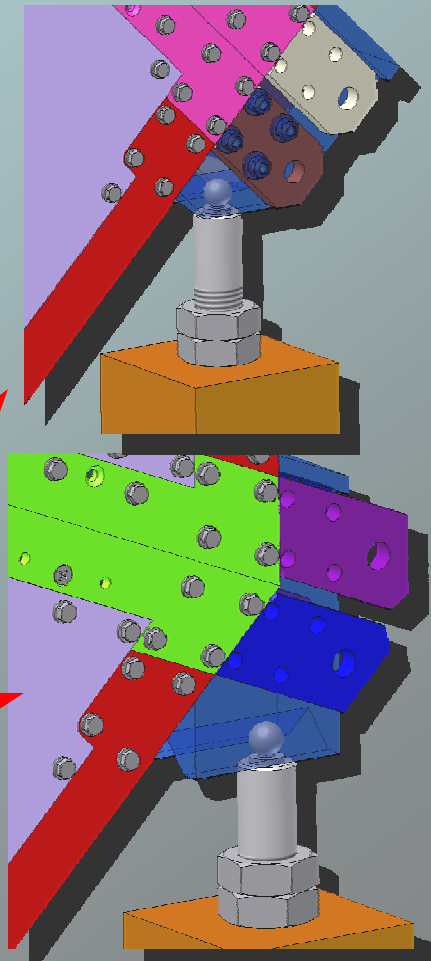
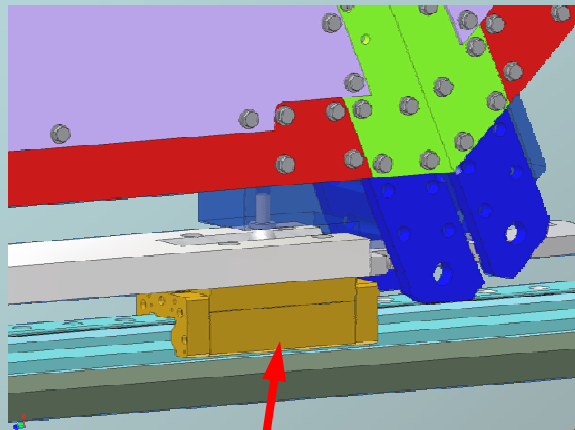
RPC3 North Detector Installation

Interconnecting pieces for inter-half-octant joints

- Bottom 4 joints have ball ends to seat into sockets on rail cars and self locking/self aligning features (cannot be reached) 1st octant has adjustable ball mounts, 2nd and 3rd octants have grooves – mating ball mounts are on sliding base
- Next 5 have self aligning features to assist alignment (3 can be reached from outside, 1 from inside, 1 from top)
- Outer interconnecting blocks have self locking tabs. Where possible they will also be bolted.
- All inner joints require no locking tabs (can be reached easily from tunnel for bolting)

RPC3 North Detector Installation

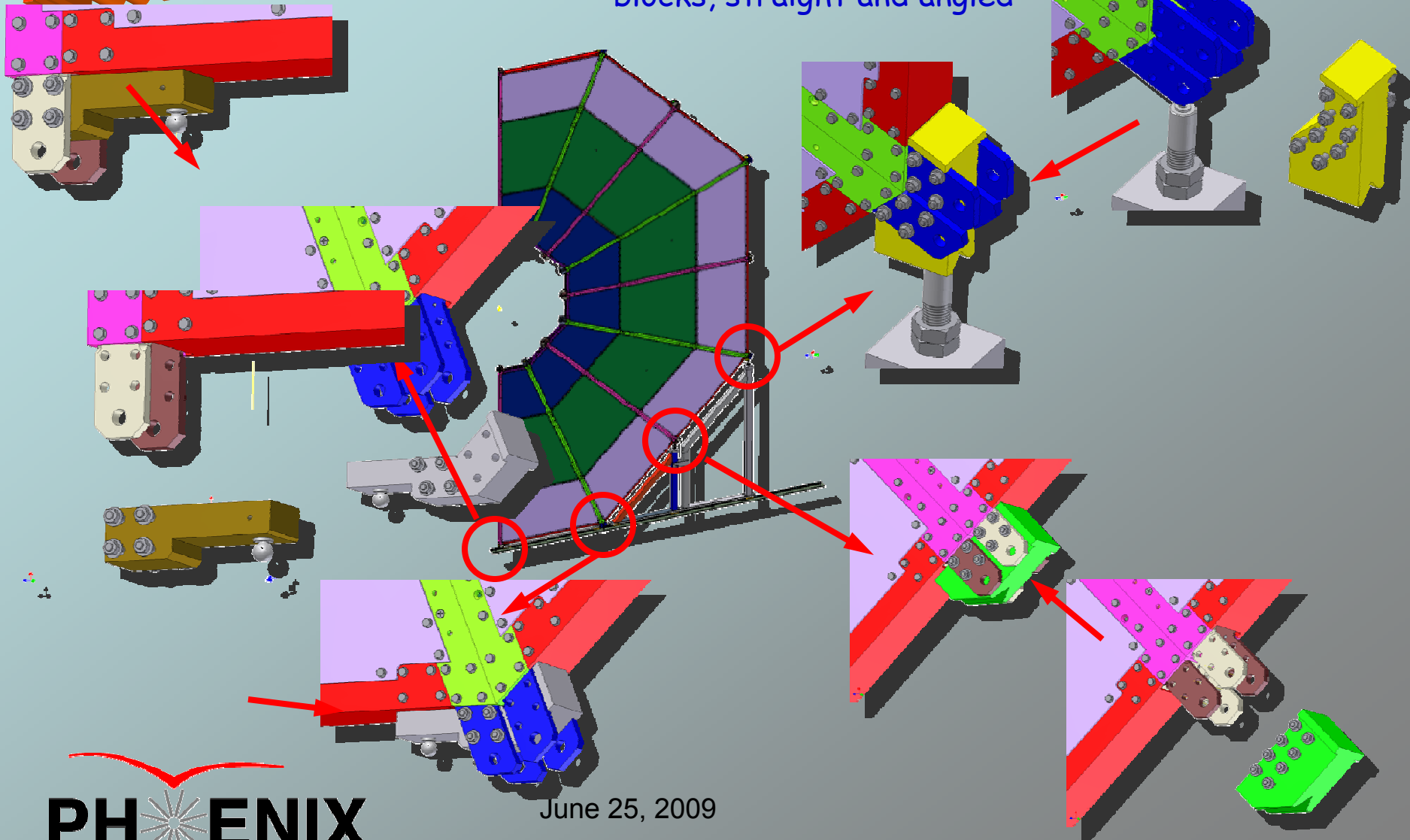
4 lower OD interconnect blocks 2 on HO_1 have adjustment balls which mate to cone & groove on base; other 2 blocks have grooves which mate with adjustment balls on base columns. East and west are the same.



Note: All interconnects to have bolt holes for both Half octants connected whether used or not.

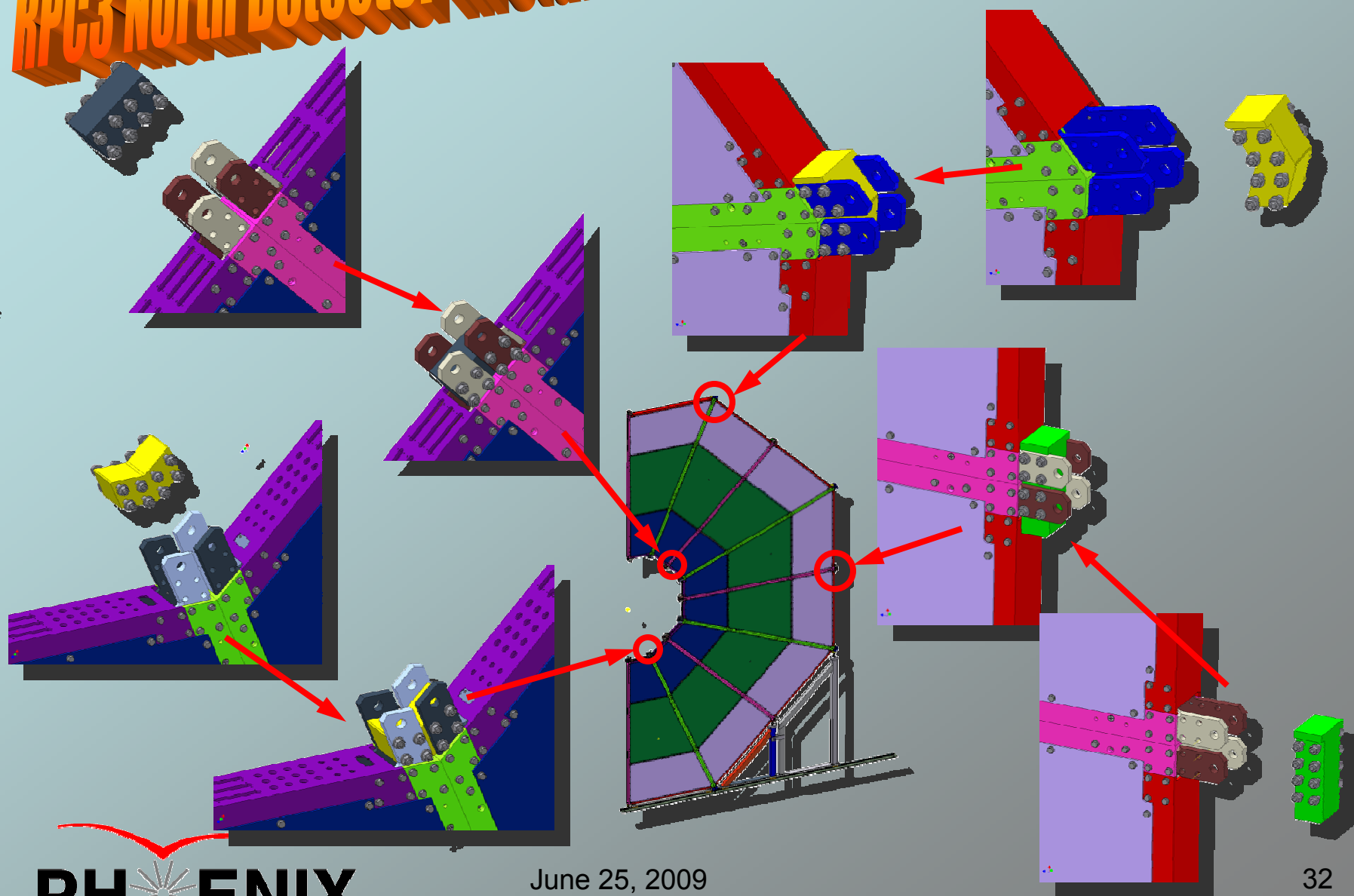
RPC3 North Detector Installation

Lower outer connecting blocks, straight and angled



RPC3 North Detector Installation

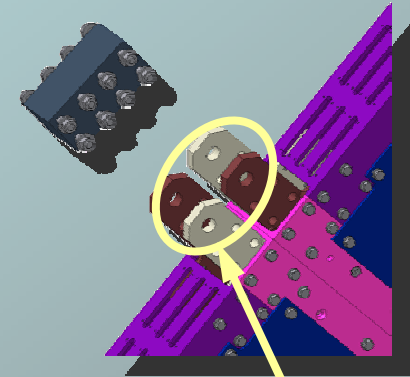
Upper inner and outer connecting blocks, straight and angled



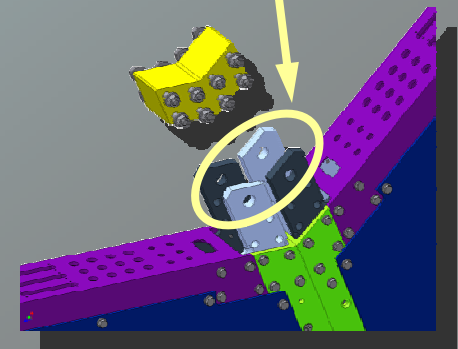
RPC3 North Detector Installation

Each half octant has holes on each of its mounting brackets on the brackets which will be used for mounting survey targets which will be visible to survey equipment in the tunnel. These targets will be relatable to the IP by survey and will have been presurvey to relate the inner positions of appropriate detector components. Initial survey of HO_1 W and HO_1 E to establish verticality of the HO_1's which are adjustable will also use these references. All other HO's are stacked into fixed positions by bolted connections and survey is used to record their final positions.

(Needs to be coordinated with half octant fabrication.)



These holes to be used for survey



RPC3 North Detector Installation

Survey fixture and procedure is still under consideration

Alignment/precision Goals for RPC3 N:

X: +/- 1.0 mm relative to beam CL, +/- 0.4 mm relative to East base
Y: +/- 1.0 mm relative to beam CL, +/- 0.4 mm relative to East base
Z: +/- 10.0 mm relative to beam CL, +/- 0.4 mm relative to East base
Roll (X-Y plane): +/- 0.1 deg relative to vertical plumb and to each other
Pitch (Y-Z plane): +/- 0.1 deg relative to horizon and to each other
Yaw (X-Z plane), +/- 0.1 deg relative to horizon and to each other

RPC3 North Detector Installation

3. Installation Plan

RPC3 North Detector Installation

- 3. Installation Plan
 - a. Simulation practice at RPC Factory

RPC3 North Detector Installation

Prior to commencing installation of the RPC3N components into the PHENIX gap 5 North, PHENIX engineers and technicians, appropriate RPC group personnel and BNL tradespersons will perform several simulated procedures in the Factory for the following purposes:

1. To test new lifting fixtures
2. To test lifting and maneuvering simulated (mock) $\frac{1}{2}$ octants into a simulated gap 5
3. To assess the grout application in a simulated gap 5
4. To assess the suitability of various grout compounds for the RPC3N gap 5 application.
5. To familiarize key personnel (PHENIX, RPC and BNL trades) with the equipment, fixtures and coordination required to efficiently, effectively and safely accomplish the required tasks for this project in a controlled environment.

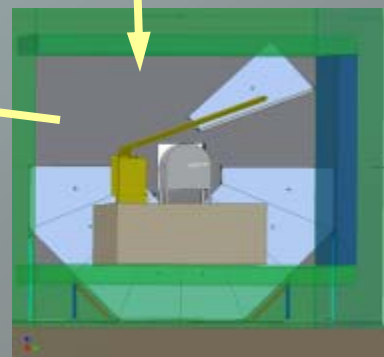
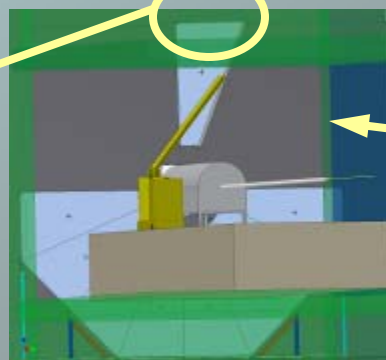
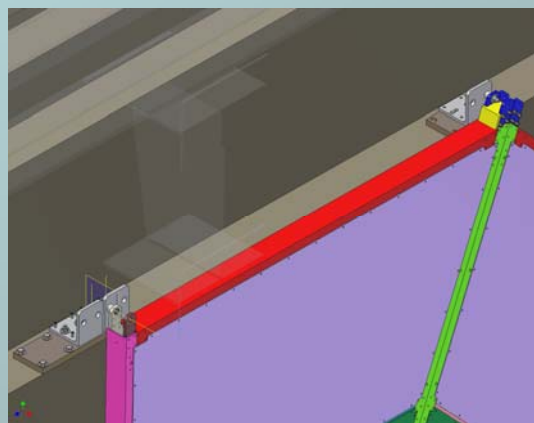
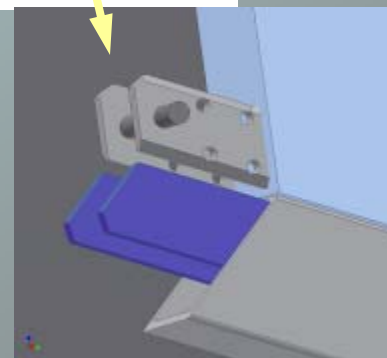
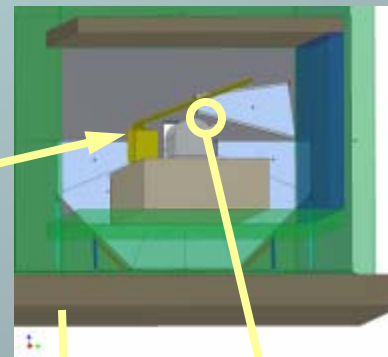
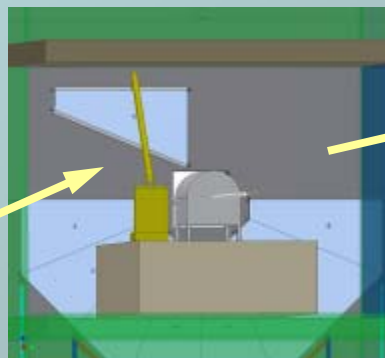
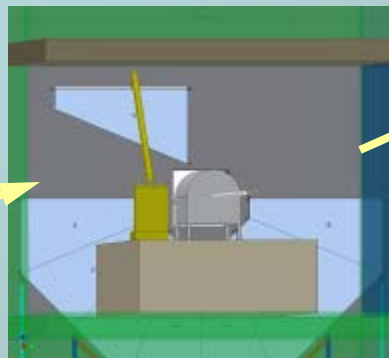
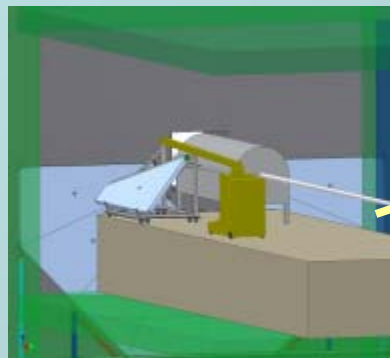
It is reasonable to expect that some modifications to the procedures described herein may be proposed as a result of these simulations. It shall be the responsibility of the PHENIX project engineer for the RPC project to assure that any significant changes to the procedures, equipment and fixtures are reviewed, inspected and approved as appropriate with cognizant PHENIX, CAD and/or BNL safety personnel.

RPC3 North Detector Installation

- 3. Installation Plan
 - b. Gap 5 MuID steel prep

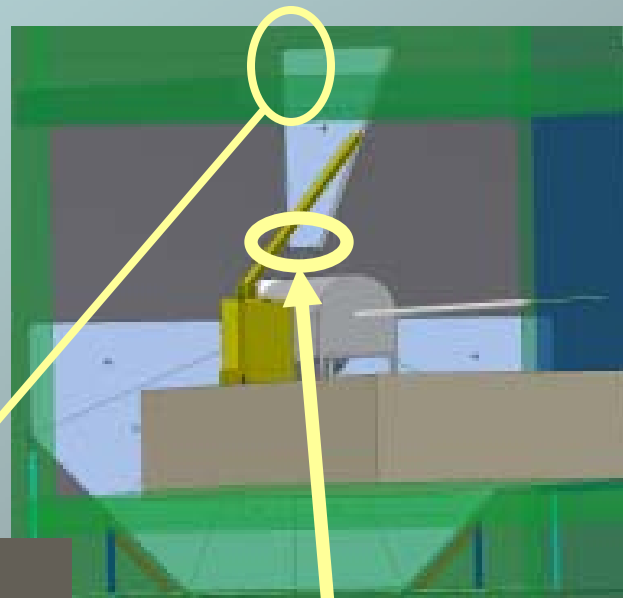
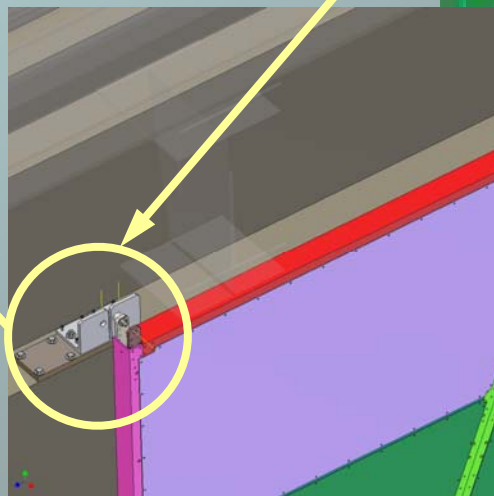
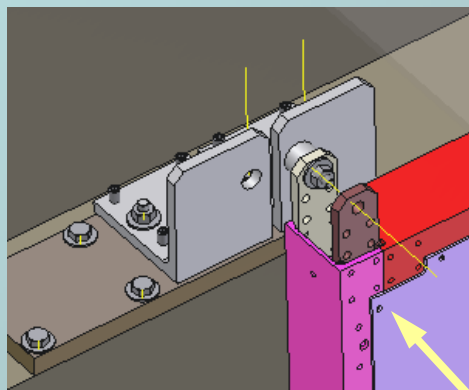
RPC3 North Detector Installation

Half Octant West #8



RPC3 North Detector Installation

Half Octant West #8



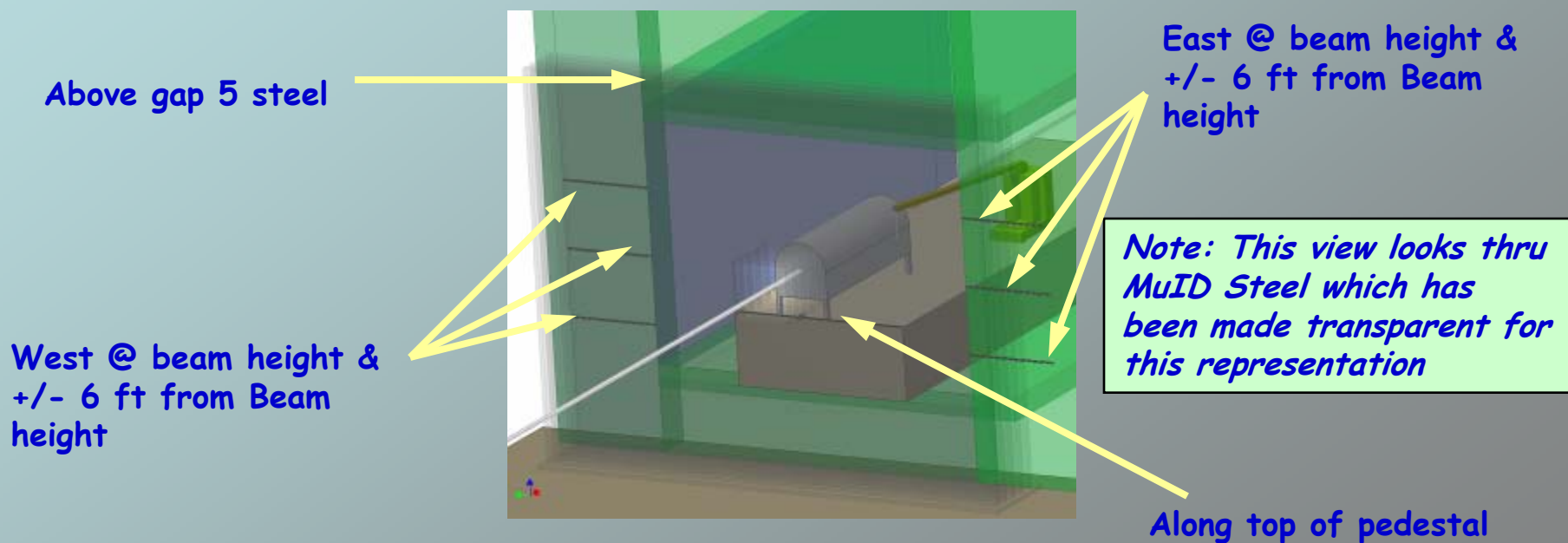
Taped Holes on
MuID Steel at inner
brackets

RPC3 North Detector Installation

- 3. Installation Plan
 - c. Pitch Control hardware installation

RPC3 North Detector Installation

After the base support structures have been installed, Install the unistrut guide rails at the pedestal and at beam height levels and $\pm \sim 6$ ft from beam height on east and west tunnel walls as shown. These rails will be used to prevent pitch rotation (about the horizontal axis perpendicular to the beamline [X-axis]). In addition there will be 4 sets of adjustable brackets above the MuID Steel adjacent to gap 5 and corresponding to the upper bracket ears on Half-octants HO_8 east and HO_8 west.



RPC3 North Detector Installation

- 3. Installation Plan
 - d. Support Base installation

RPC3 North Detector Installation

Installing the east and west base supports

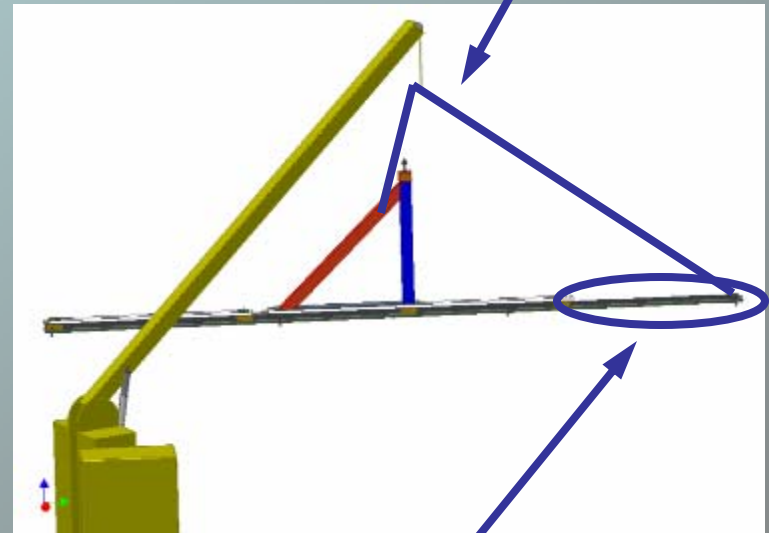
- Pour 1st (rough) grout layer and allow grout to cure
- Assemble the base to install configuration
- Preset leveling screws to best guess settings
- Lower the assembled base into the east side using the walk behind crane with cable hoist
- Position east base support as follows:
 1. Locate plate for best IR side station plane nominal vertical centerplane
 2. Check alignment with 1st octant survey tool
 3. Hoist assembled base and refine leveling screw adjustments
 4. Repeat until within design requirements
- Position west base in the same manner. West base must mate with east base to control pitch plane and roll plane
- Pour in grout until level reaches no more than half way up base plates.
- Allow to settle. Add additional grout if necessary to maintain surface level above bottom surface of base plate but no more than half way up the base plate. Allow grout to cure per grout specs.

RPC3 North Detector Installation

Installing the roller support structure is the first step of installation. The procedure for this step would go something like this:

1.
 - a) Practice rigging and survey in factory with simulated gap 5
 - b) Pre-set 7 adjusting screws to 1st best guess.
 - c) Rig the west base (with rail, pillow blocks, carriage and columns) into place.
 - d) Using simulated half-octant survey scale obtain position error
 - e) Lift base, readjust leveling screws, repeat 2-4
2. Do the same for east base

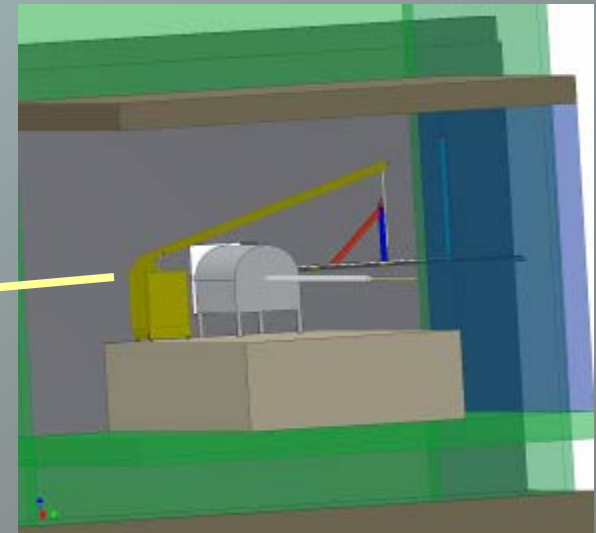
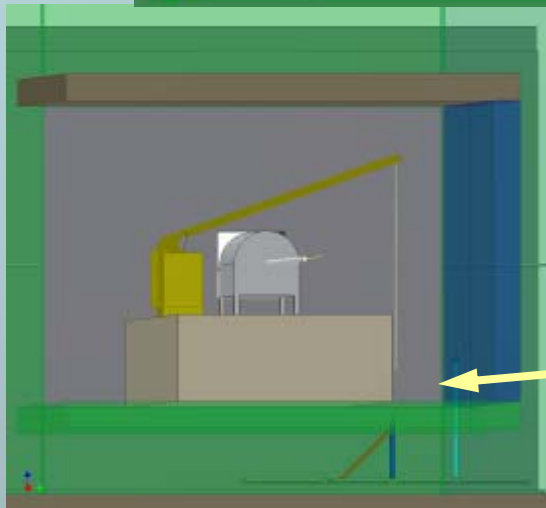
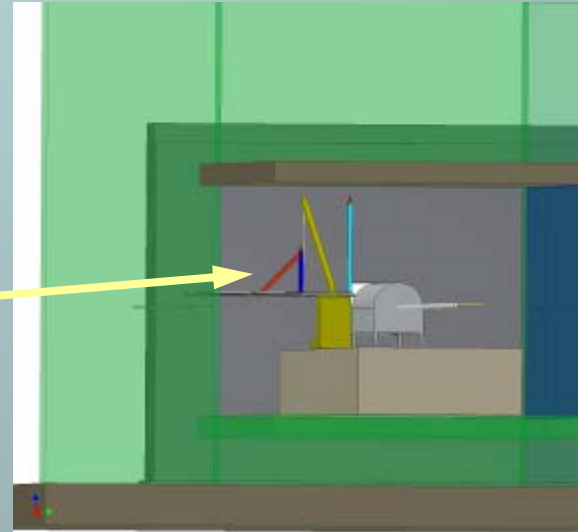
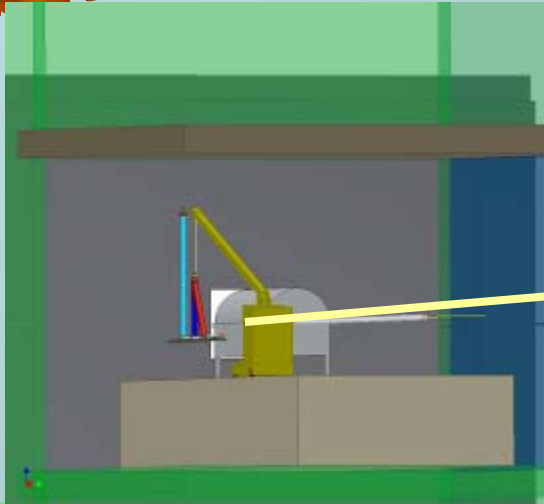
Rigid fixture or sling needed to attach at IR corner end and to short column. Fixture must lift from slightly to the beam side so that base can be accurately repositioned from IR corner side. Sling must be remotely detachable from either IR corner or tunnel floor after base is permanently set.



Fixture needs a bar in this location that locks slider in inner most position. Lock must be removable from far end floor level in IR

RPC3 North Detector Installation

Install the west base
then the east base.



RPC3 North Detector Installation

- 3. Installation Plan
 - e. Detailed Half Octant installation

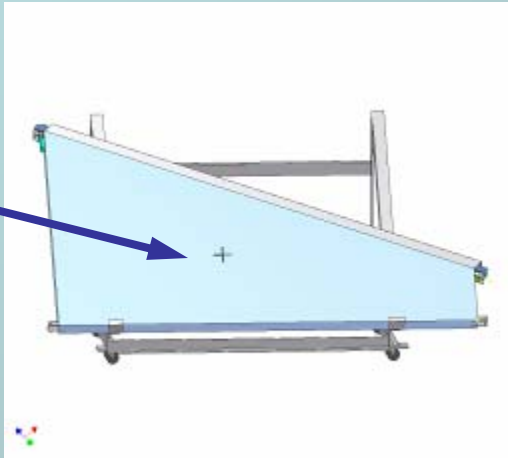
RPC3 North Detector Installation

e. Installing half octants

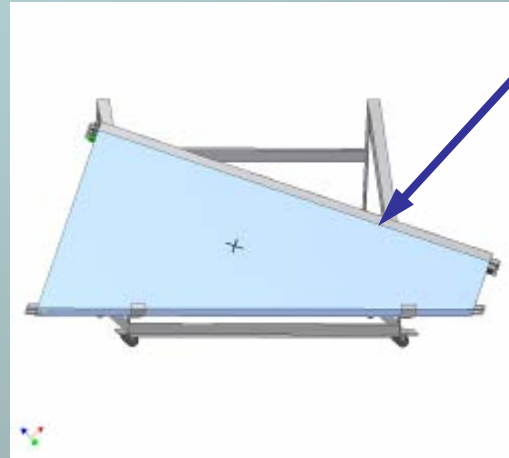
- Lower 3 octants have ball ends aligned with internal detectors and installed in interconnects prior to half octant installation
- First octant has no interconnect on vertical centerline ... alignment ball support is installed. First octants (E & W) are attached at inner tabs and upper outer tab after all octants are installed.
- Interconnects are installed on the side which mates with the next half octant to be installed; side which mates with previously installed half octant slides onto interconnect already on previously installed half octant prior to half octant transport to tunnel for installation
- Octants are loaded onto angled transport cart at factory and transported by riggers to tunnel loading dock from where they are wheeled to the gap 5 area
- Install octants in accordance with its assigned sequence Individually described later in this document.

RPC3 North Detector Installation

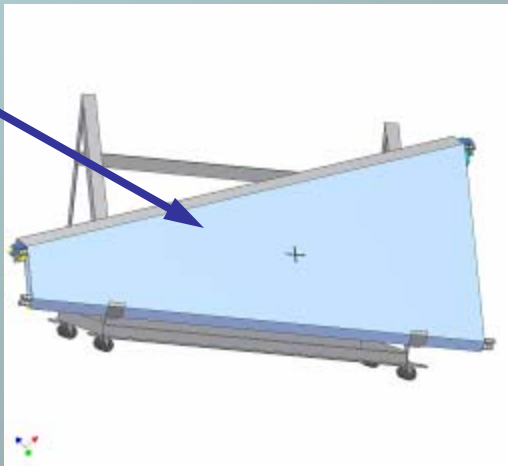
A. Fixture on long side, octants E1, E3, E5 & E7



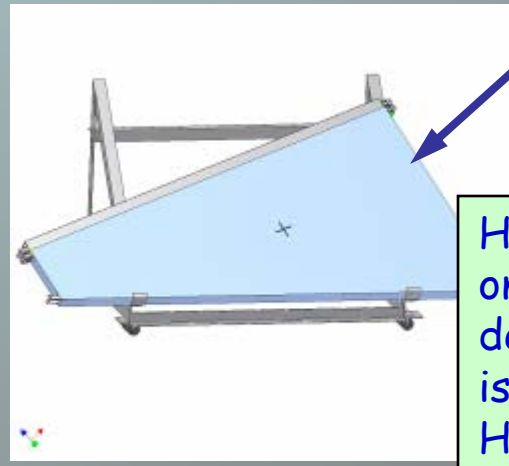
B. Fixture on short side, octants E2, E4, E6 & E8



C. Fixture on long side, octants W1, W3, W5 & W7



D. Fixture on Short side, octants W2, W4, W6, W8



How HO's are loaded onto transport cart depends on which HO is to be installed. HO's are numbered bottom to top

RPC3 North Detector Installation

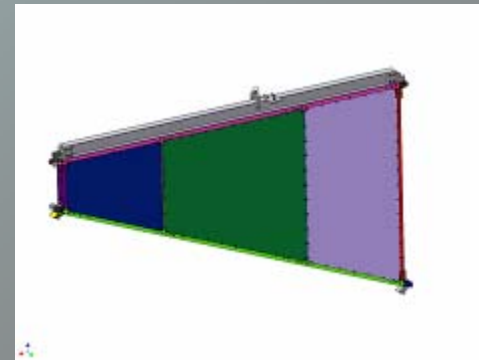
Installation tools/fixtures required to install the RPC3 HO's include the following:

1. Existing walk-behind crane with telescoping/2axis rotating boom and integrated hoist.



Lifting capacity 1650 lbs at full extension (22 feet)

2. Two Strongback lifting/orienting fixtures (already appearing in previous slides)
All 4 fixtures are conceptually similar, differ in orientation (east or west) with respect to cg and the side they are attached to (long or short)



RPC3 North Detector Installation

3. Transport cart (transports HO's at an angle to fit all access corridors)



4. Vertical one man man-lift.
This will be used in the east and west floors below the pedestal to access all areas on the MuID steel wall for set up and installation of the half octants.



RPC3 North Detector Installation

C. 1st HO on West side is installed as follows:

Place 1st Half Octant on angled cart with long side facing up and wide end to the left (call this the west1 position)

Move the cart into the north tunnel and roll it south on the east side of the pedestal to about 2 feet from the MuID steel.

Move the walk behind crane close and attach the hoist to the horizontal lift position.

Lift the HO_1 west over the DX magnet and lower it into the cradle (not yet defined) which has been prepositioned in the west trench.

Detach the hoist from the horizontal lift position and move it to the vertical lift position

RPC3 North Detector Installation

Lift the HO_1 and position it on the west base support

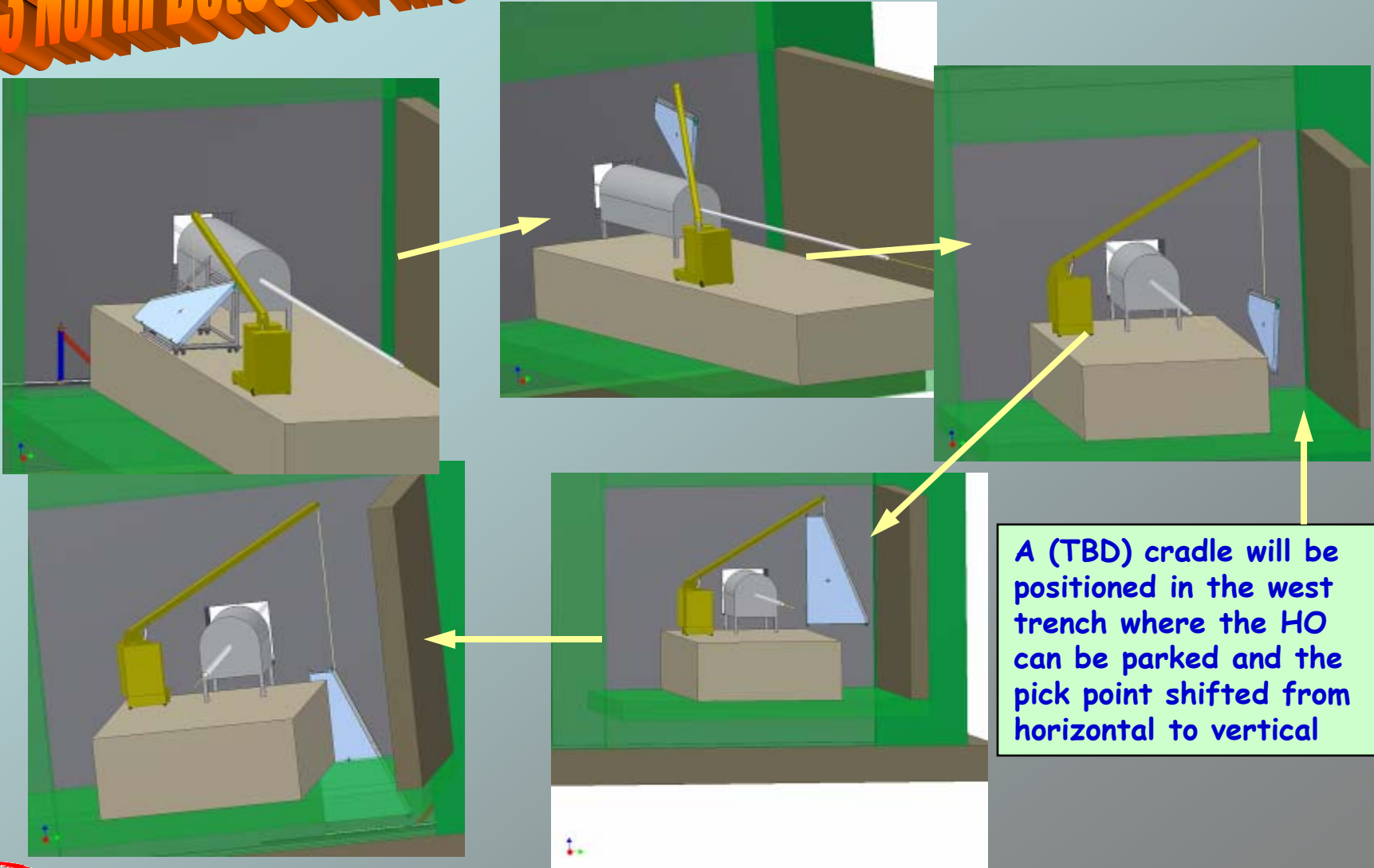
Survey, lift HO_1, adjust ball for HO verticality, lower HO_1 onto base. Repeat until vertical in x-y plane.

Before HO_1 west is lowered onto the base support structure, the support shall be slid 60 inches west (furthest that base will slide without dismounting the westernmost bearing car). This will aide and ease the locating of the HO on the base.

After HO_1 west is in place the upper sliding clamp will be attached to HO_1 west, inserted into the unistrut guide and adjust to make HO_1 west stand vertical in y-z plane.

RPC3 North Detector Installation

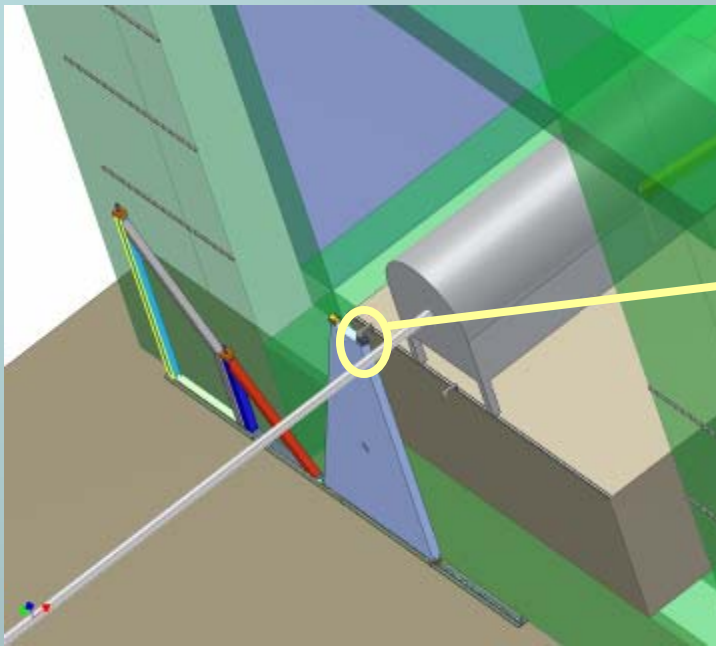
Half Octant West #1



RPC3 North Detector Installation

Half Octant West #1, cont'd

After HO1 west is installed, the clamp/spacer shown is used to keep the HO stable in the vertical configuration. Clamp/spacer is idealized actual clamp will have adjustments to align the pitch angle.



Clamp/Spacer

Unistrut rail

Note: These views look thru MuID Steel which has been made transparent for this representation

RPC3 North Detector Installation

2nd HO on West side is installed as follows:

Place 2nd Half Octant on angled cart with short side facing up and wide end to the left (call this the west2 position)

Move the cart into the north tunnel and roll it south on the east side of the pedestal to about 2 feet from the MuID steel.

Move the walk behind crane close and attach the hoist to the horizontal lift position.

Lift the HO_2 west over the DX magnet and lower it into the cradle (not yet defined) which has been prepositioned in the west trench.

Detach the hoist from the horizontal lift position and move it to the octant 2 lift position

Lift the HO_2 and position it on the west base support in the octant 2 position taking care to interlock the outer brackets to the HO 1-2 outer interconnect, then bolt HO_1 and HO_2 together using the angled inner interconnect

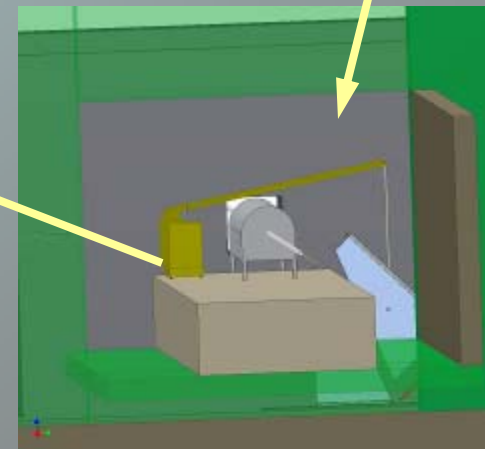
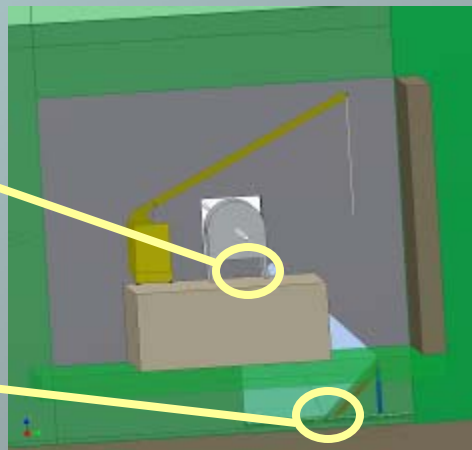
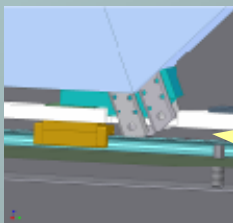
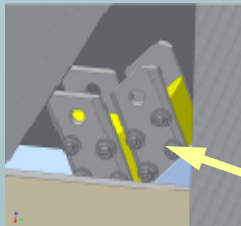
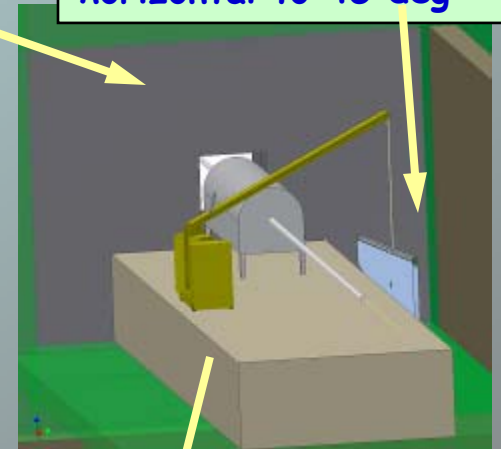
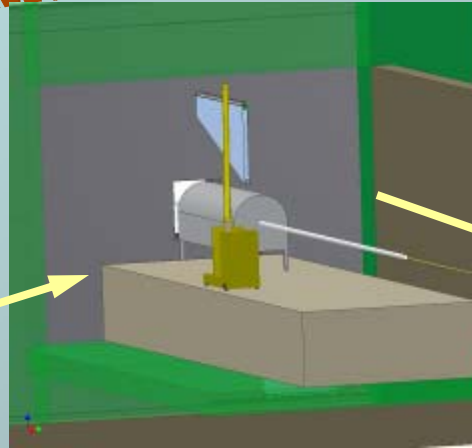
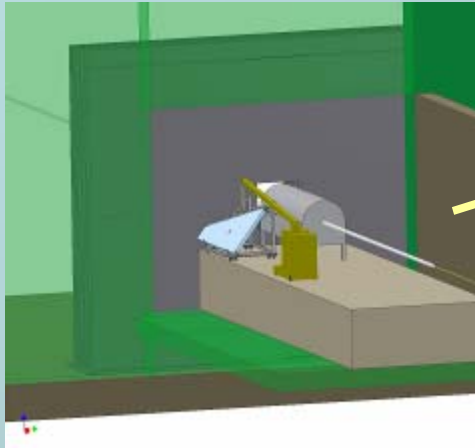
Slide the base support to the in position (0 inches slid to the west)

Reaching down in gap adjust ball on small column as necessary.

RPC3 North Detector Installation

Half Octant West #2

A (TBD) cradle will be positioned in the west trench where the HO can be parked and the pick point shifted from horizontal to 45 deg



RPC3 North Detector Installation

3rd HO on West side is installed as follows:

Place 3rd Half Octant on angled cart with long side facing up and wide end to the left (west1 position)

Move the cart into the north tunnel and roll it south on the east side of the pedestal to about 2 feet from the MuID steel.

Move the walk behind crane close and attach the hoist to the horizontal lift position.

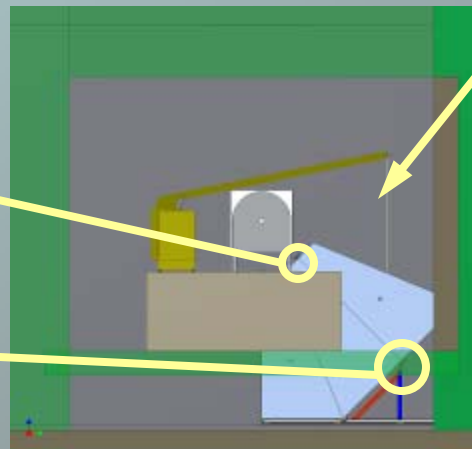
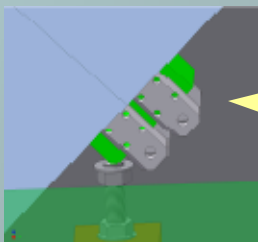
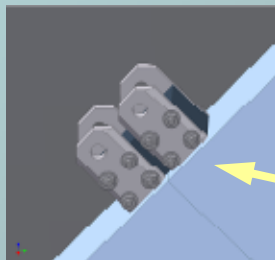
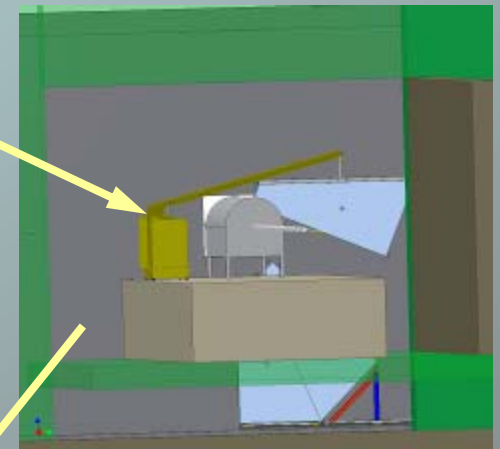
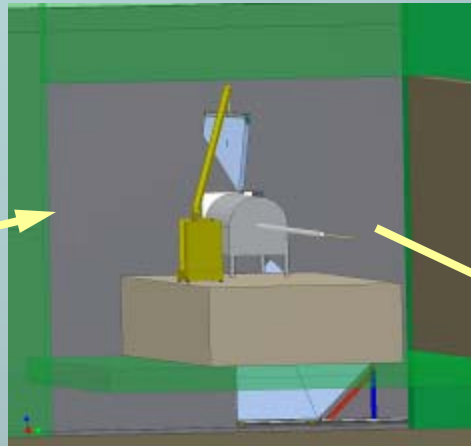
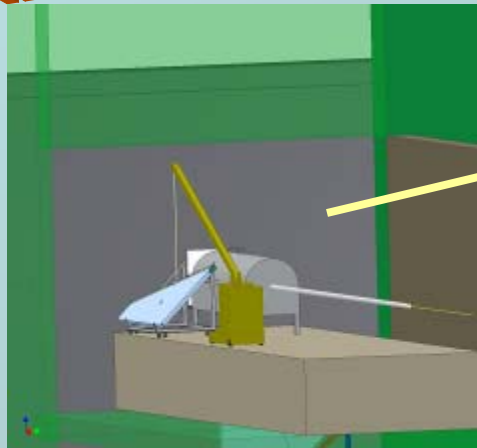
Lift the HO_3 west over the DX magnet and lower it into the west base support in the octant 3 position taking care to interlock the outer brackets to the HO 2-3 outer interconnect, then bolt HO_2 and HO_3 together using the angled inner interconnect. The HO 3 will need to be rotated into position but this should easily be accomplished by laying the inner edge on HO_2 taking advantage of gravity.

Move the HO assembly west 60 inches and adjust the support ball on the tall column as necessary.

Move the HO assembly back to the "0" position"

RPC3 North Detector Installation

Half Octant West #3



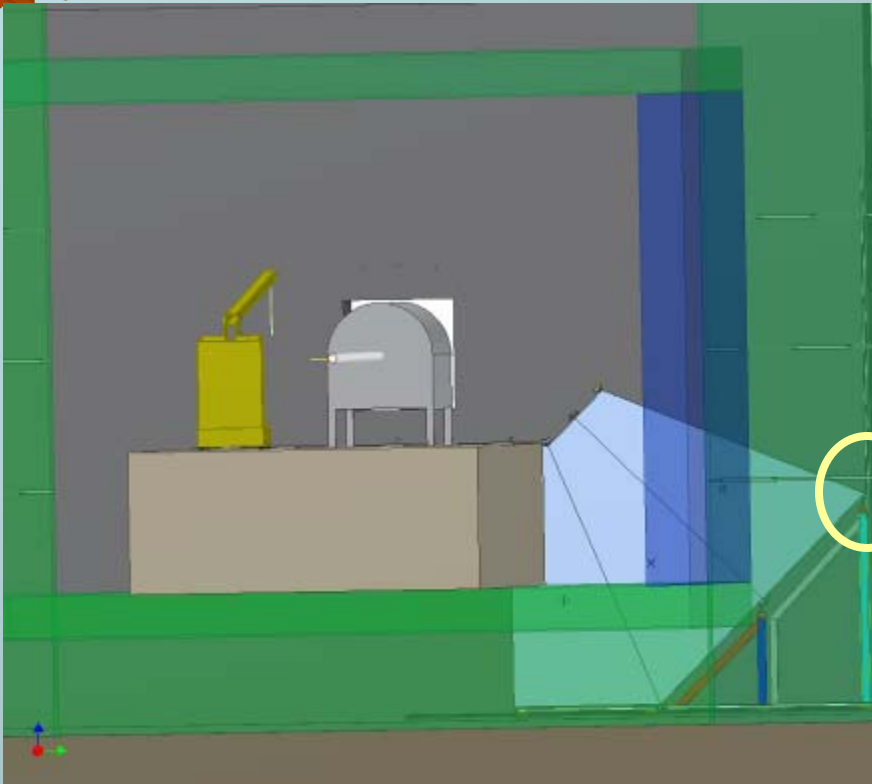
RPC3 North Detector Installation

At this point, the assembly is to be rolled out to the 60" position.

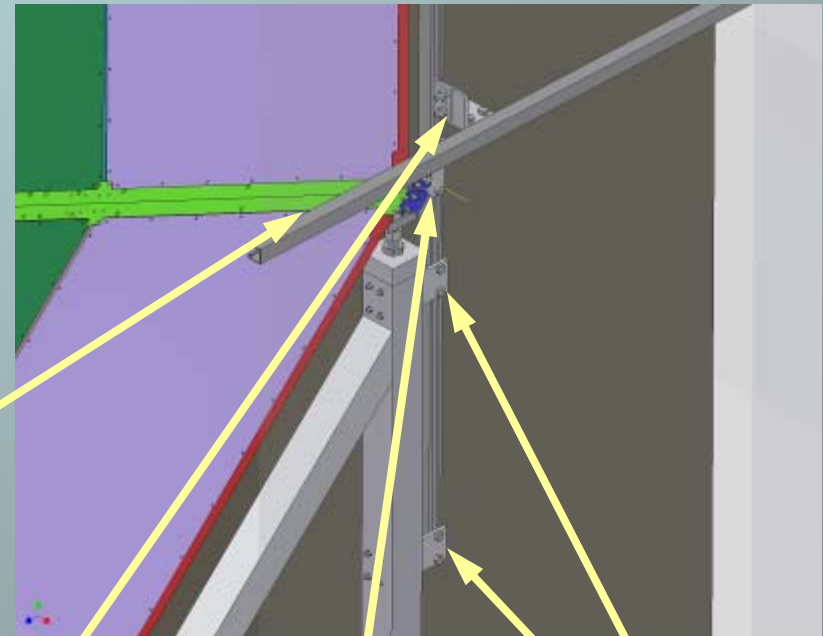
A 16 foot vertical unistrut channel is then mounted on the tall column on the rolling base assembly and connected with the X-Y roller clamps to each of the three (lower, mid and upper) horizontal unistrut guide channels. The outer-upper mounting bracket of HO_3 is then bolted to the vertical unistrut guide.

RPC3 North Detector Installation

Half Octant West #3, cont'd



Vertical and horizontal unistrut guide rails attached by double ended rollers here



HO_3 attached to vertical unistrut guide rail here

Long Column attached to vertical unistrut guide rail here

RPC3 North Detector Installation

F. 4th HO on West side is installed as follows:

Place 4th Half Octant on angled cart with short side facing up and wide end to the left (west2 position) (mid arm of lifting fixture not needed)

Move the cart into the north tunnel and roll it south on the east side of the pedestal to about 2 feet from the MuID steel.

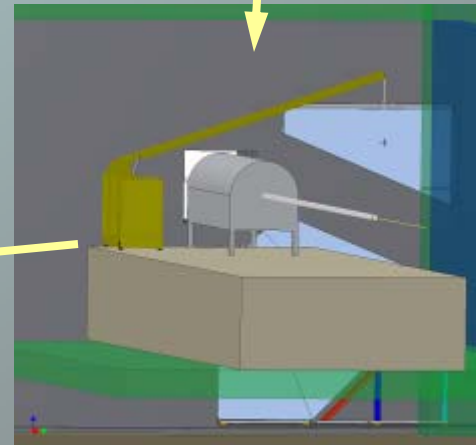
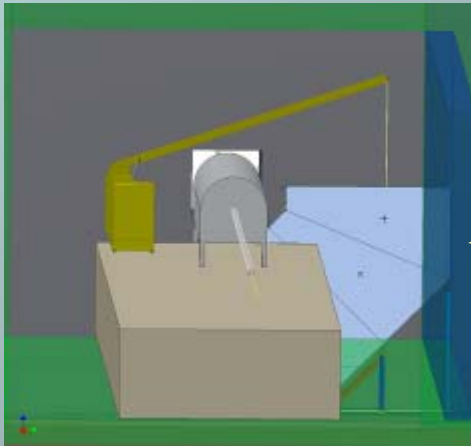
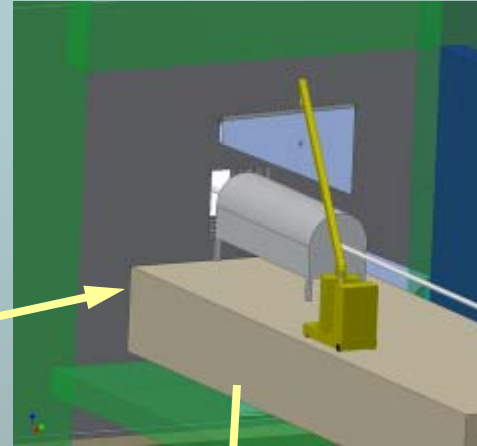
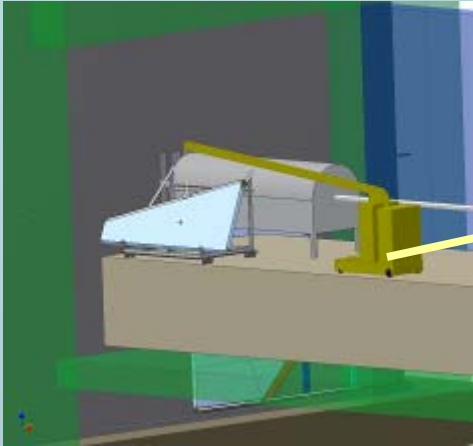
Move the walk behind crane close and attach the hoist to the horizontal lift position.

Lift the HO_4 west over the DX magnet and lower it into the west station 3 North assembly in the half-octant 4 position taking care to interlock the outer brackets to the HO 3-4 outer interconnect, then bolt HO_3 and HO_4 together using the angled inner interconnect.

Slide the west station 3 north assembly to the 60" position, ready to be attached to the unistrut guide rail at the upper back bracket.

RPC3 North Detector Installation

Half Octant West #4

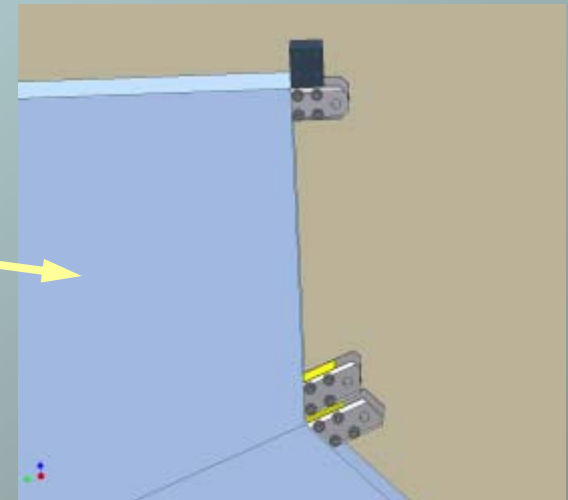
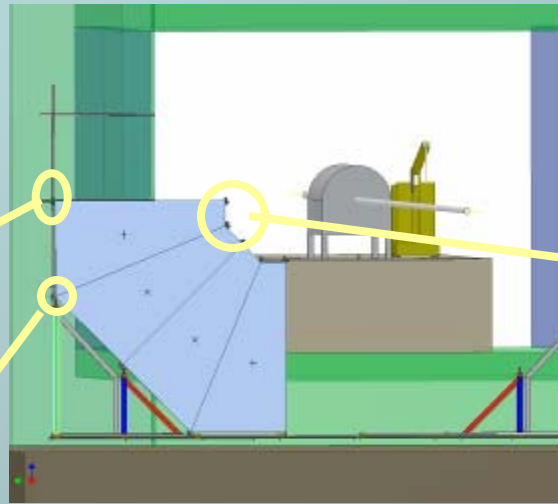


RPC3 North Detector Installation

Half Octant West #4, cont'd

Sliding
clamp

View angle
reversed for
clarity

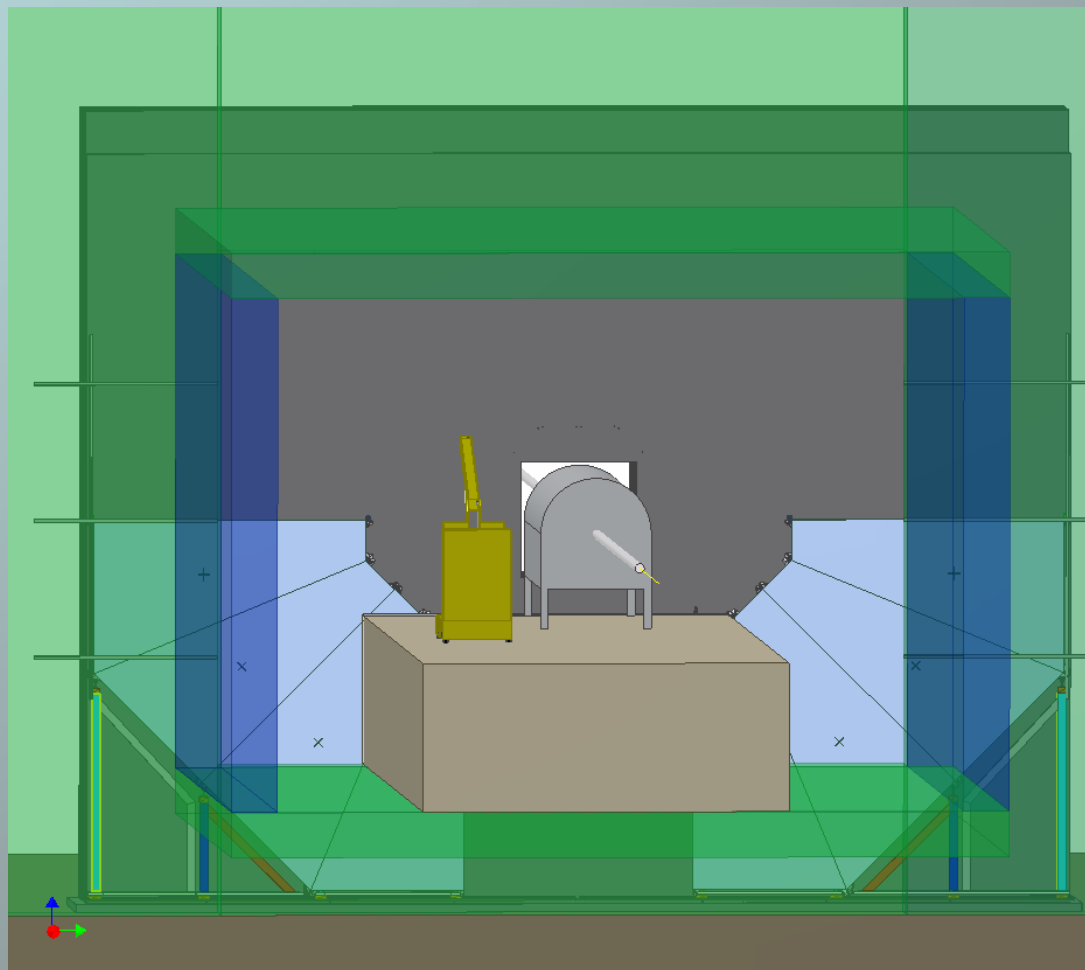


View looking thru MuID steel plates which have been made transparent. After HO_4 is positioned onto HO_3, inner angled connector at inner 3-4 joint is bolted, inner straight connector has been unbolted from lifting fixture and remains in place to accept HO_5. At outer face lower brackets have been locked into angled bracket at outer 3-4 joint and straight bracket remains in place to accept HO_5. West sliding base is slid west 60" and outer mounting bracket is attached to vertical unistrut guide. After the bracket is attached, slide the base back to the 0 position.

RPC3 North Detector Installation

HO_1 East through HO_4 East

6. Half Octants HO_1 East through HO_4 East are installed similarly to their western counterparts. After these have been installed, both the east and west bases should be slid outward to their 60 inch positions.



RPC3 North Detector Installation

H. 8th HO on West side is installed as follows:

Place 8th Half Octant on angled cart in west2 position

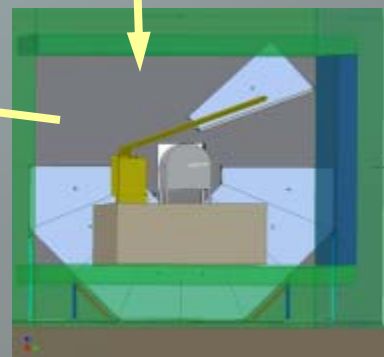
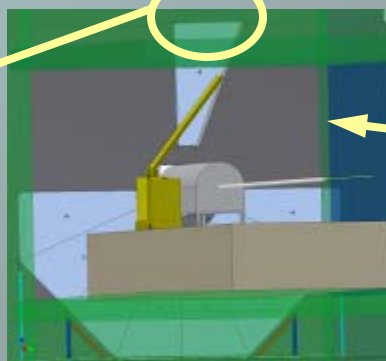
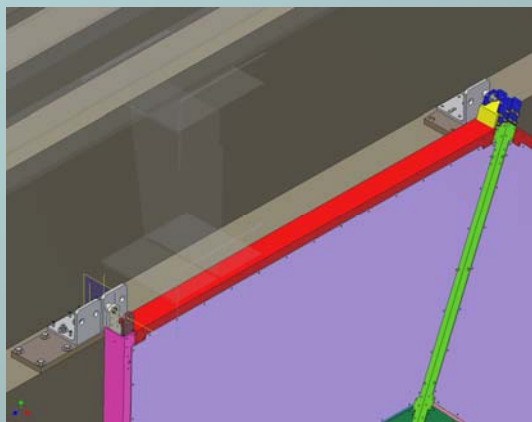
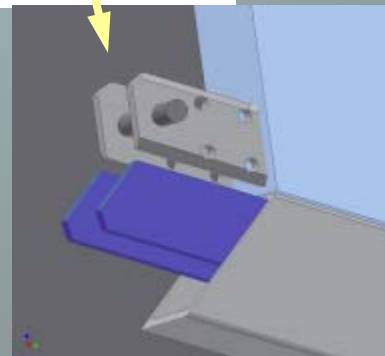
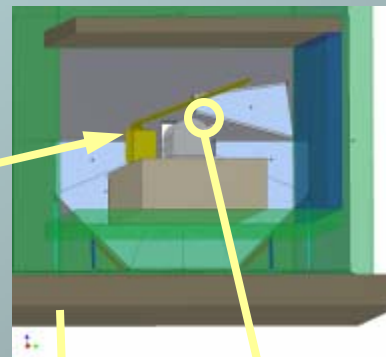
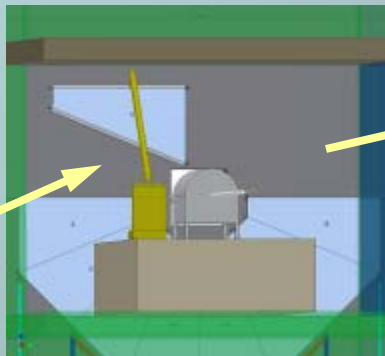
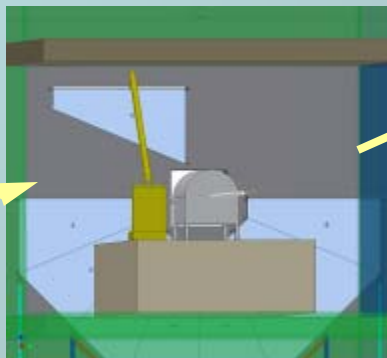
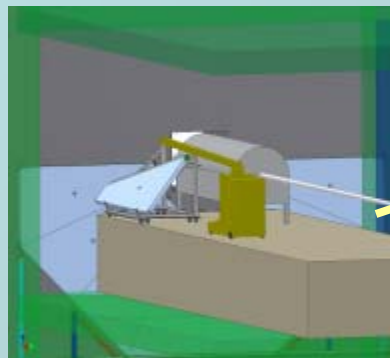
Move it to the gap 5 wall as before

Lift the HO_8 west over the DX magnet and raise it into the west station 3 North assembly in the octant 8 position resting on HO_7 west as high as the walk behind crane can get it. Technicians on the MuID steel above this station shall use guide lines to assure that the half octant remains oriented correctly while the elevating feature of the lifting fixture is used to raise HO_8 until it interlocks with the outer bracket in the HO 7-8 outer interconnect. Then bolt HO_7 and HO_8 together using the angled inner interconnect. If Possible also bolt the HO's together at the upper outer interconnect.

Finally, after the lifting fixture has been disconnected, unbolt the upper straight interconnect on the upper east interconnect and turn it around and rebolt it into place with the un-tabbed edge protruding to accept HO_8East when the rest of station 1 is completed.

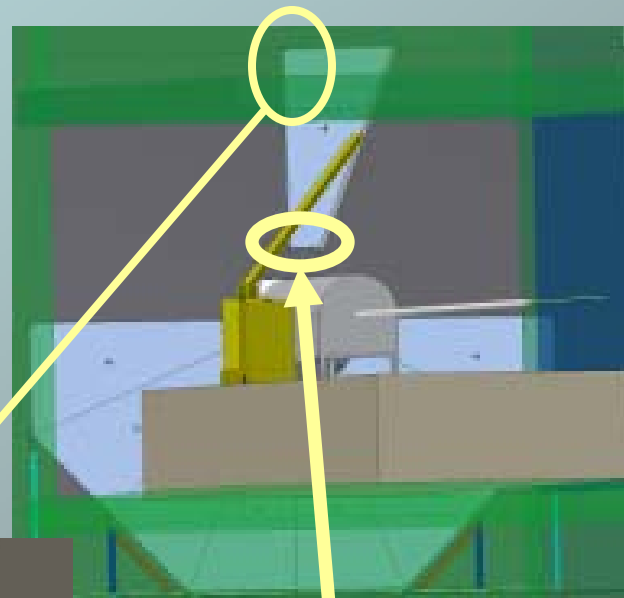
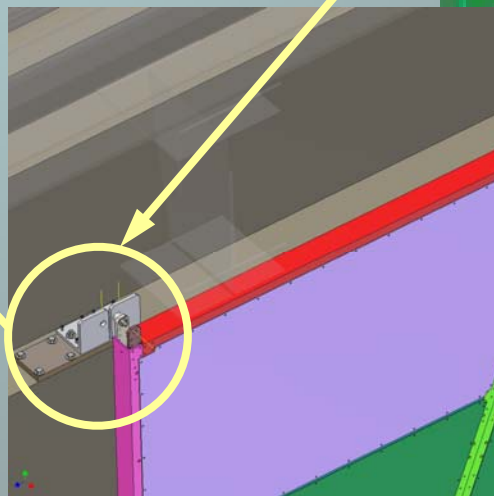
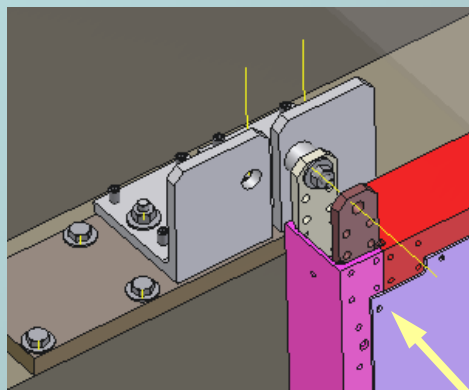
RPC3 North Detector Installation

Half Octant West #8



RPC3 North Detector Installation

Half Octant West #8



Taped Holes on
MuID Steel at inner
brackets

RPC3 North Detector Installation

I. 7th HO on West side is installed as follows:

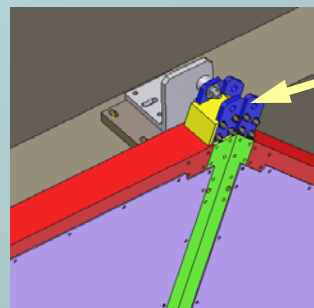
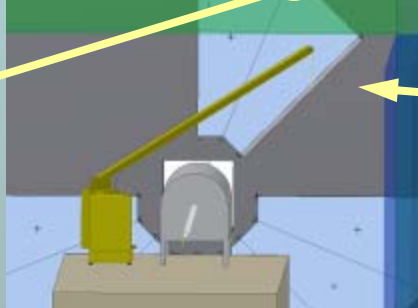
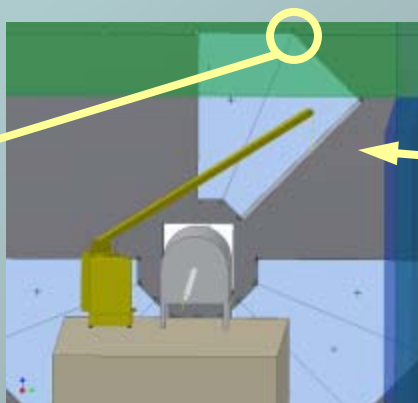
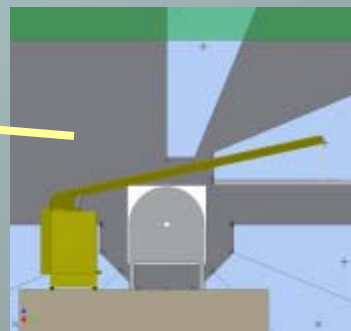
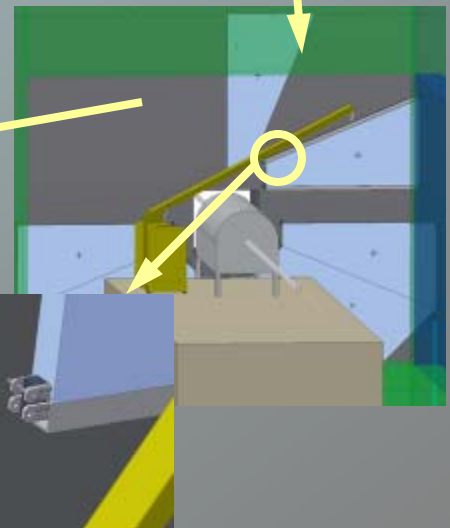
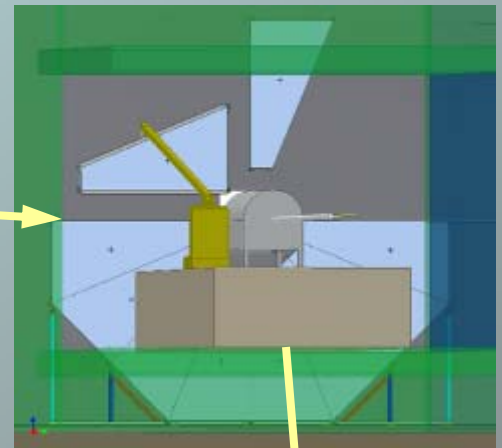
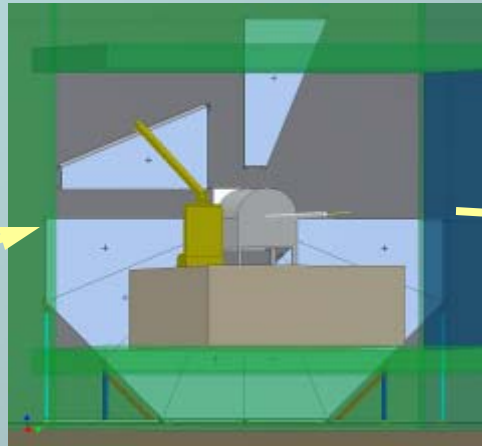
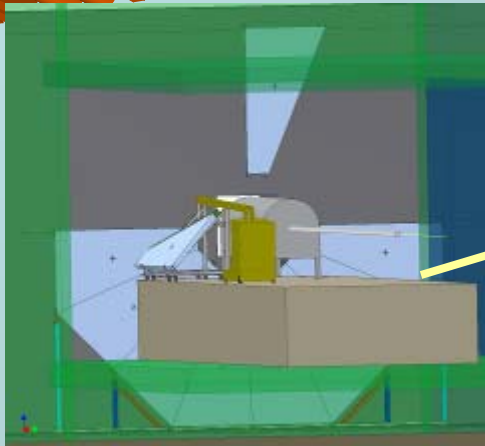
Place 7th Half Octant on angled cart in west 1 position

Move it to the gap 5 wall as before

Lift the HO_7 west over the DX magnet and raise it into the west station 3 North assembly in the octant 7 position taking care to interlock the outer brackets to the HO 6-7 outer interconnect, then bolt HO_6 and HO_7 together using the angled inner and outer interconnects.

RPC3 North Detector Installation

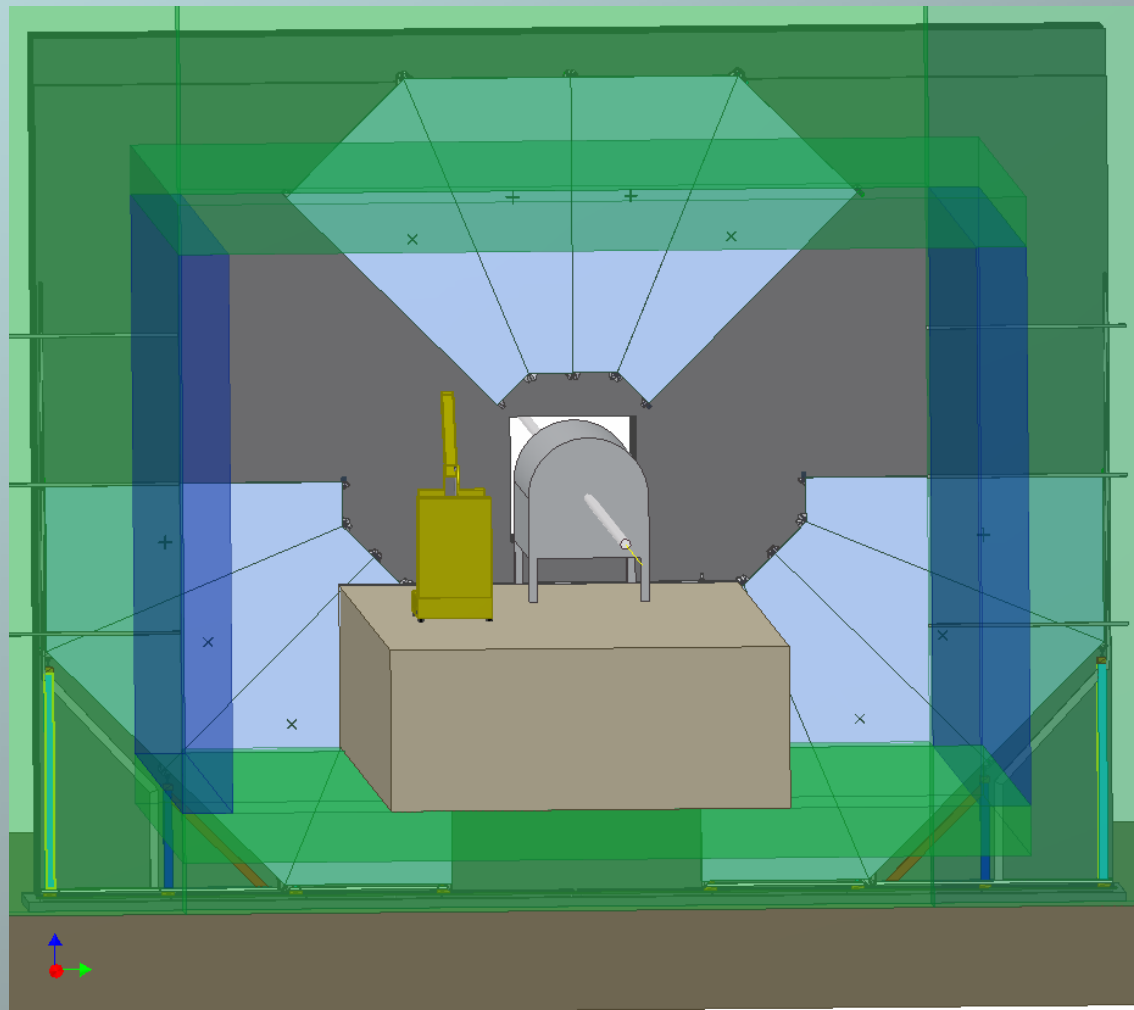
Half Octant West #7



RPC3 North Detector Installation

HO_8 East and HO_7 East

J. Half Octants HO_8 East and HO_7 East are installed similarly to their western counterparts.



RPC3 North Detector Installation

K. 5th HO on West side is installed as follows:

Place 5th Half Octant on angled cart with long side facing up and wide end to the left (west1 position)

Move the cart into the north tunnel and roll it south on the east side of the pedestal to about 2 feet from the MuID steel.

Move the walk behind crane close and attach the hoist to the horizontal lift position.

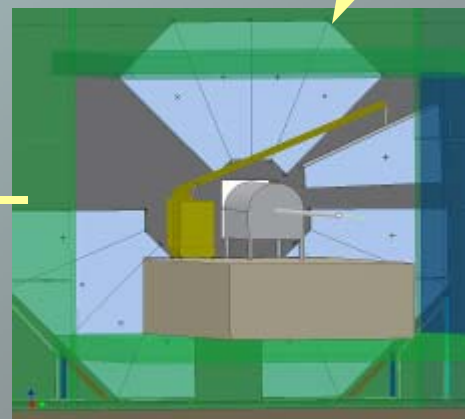
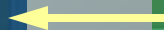
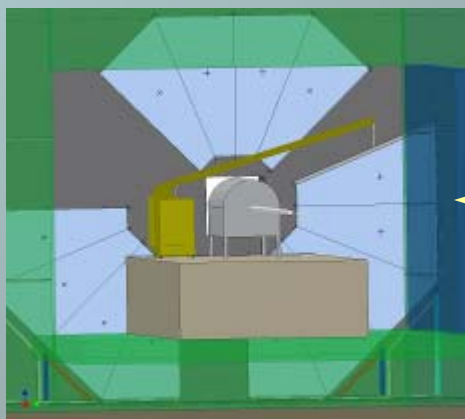
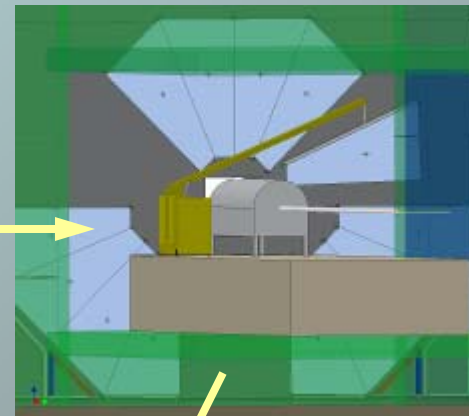
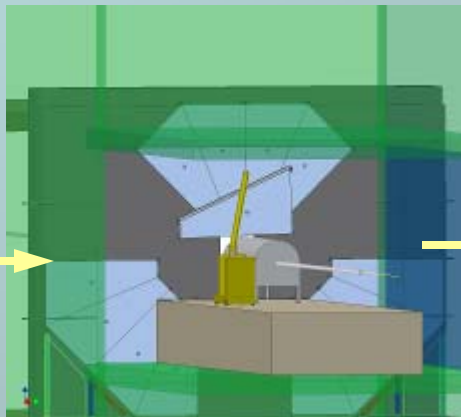
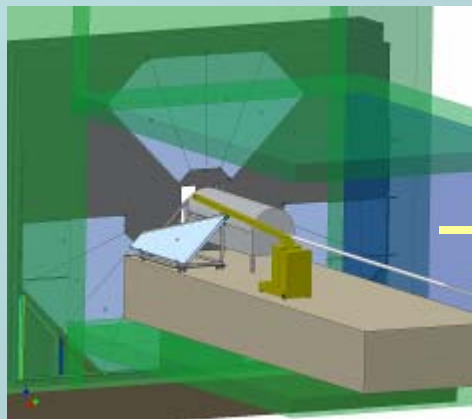
Lift the HO_5 west over the DX magnet and steer it into a position just above the west station 3 North assembly octant 4.

Slide the west station 3 North assembly to a position ~ 10 inches from the 0 position, then lower the HO_5 west into position taking care to interlock the outer brackets to the HO 4-5 outer interconnect, then bolt HO_4 and HO_5 together using the angled inner interconnect.

Move the HO assembly to the 60" position and bolt together at the outer HO_4-5 interconnect and attach the upper HO_5 outer bracket to the vertical unistrut guide.

RPC3 North Detector Installation

Half Octant West #5



RPC3 North Detector Installation

L. 6th HO on West side is installed as follows:

Move the west base assembly from the +60" position to approximately +15".

Place 6th Half Octant on angled cart in west 2 position.

Move it to the gap 5 wall as before.

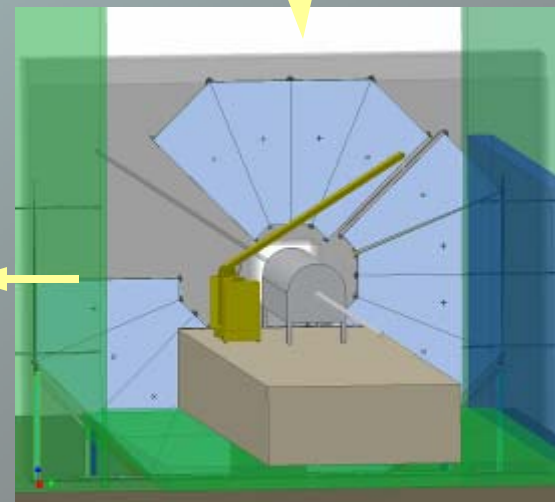
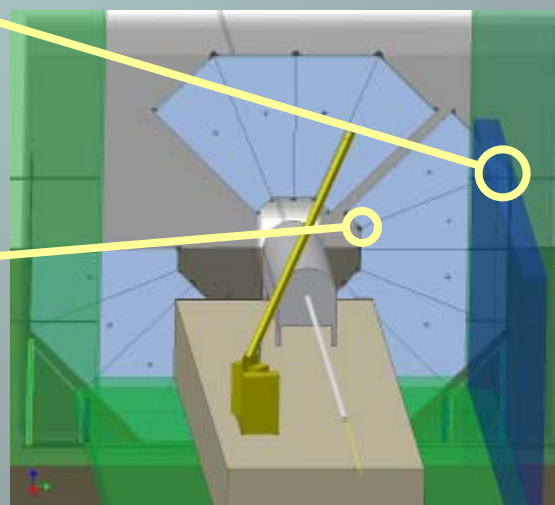
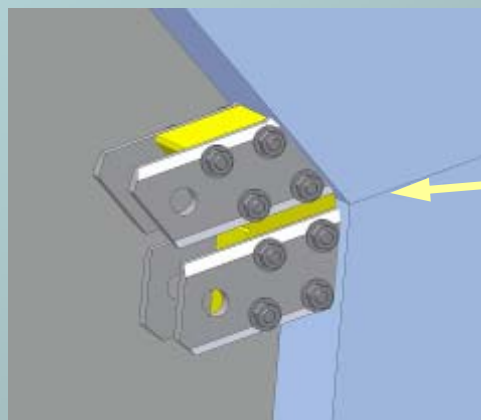
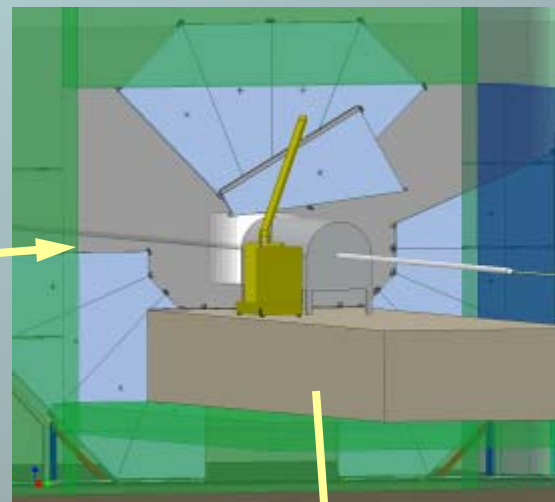
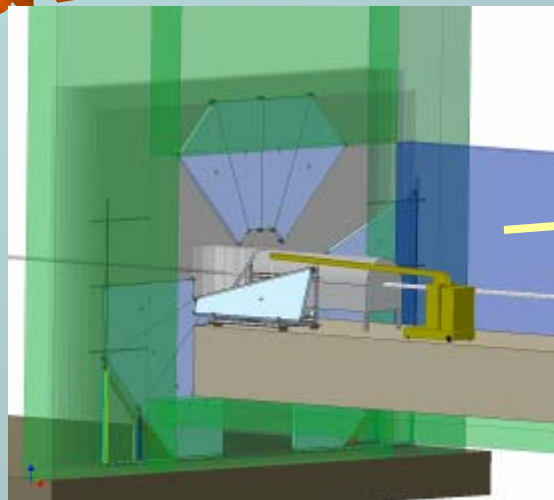
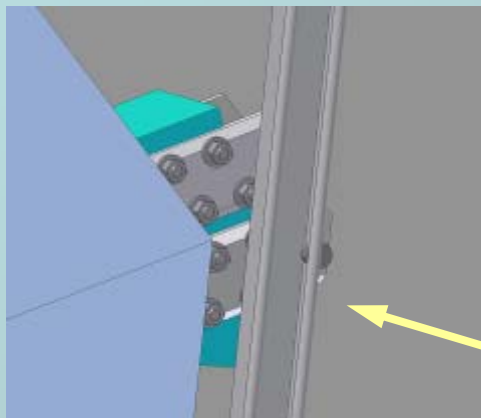
Lift the HO_6 west over the DX magnet at the +1 wide side lifting position and position it lower it into the west station 3 North assembly in the octant 6 position. A technician in the manlift will need to guide the wide end into the interconnecting outer brackets at the HO 5-6 outer interconnect, then bolt HO_5 and HO_6 together using the angled inner interconnect.

Move the assembly to the 60" position and bolt the outer angled connector at the 5-6 outer interconnect.

Move the assembly back to near the 0" position where the technician in the manlift will need to switch the outer HO_6-7 interconnect bracket so the locking tab is on the octant 6 side. Then move the assembly the rest of the way into the zero position and bolt together the inner and outer HO_6-7 interconnect brackets. (Note this may require height adjustments at the HO_7-8 supports.)

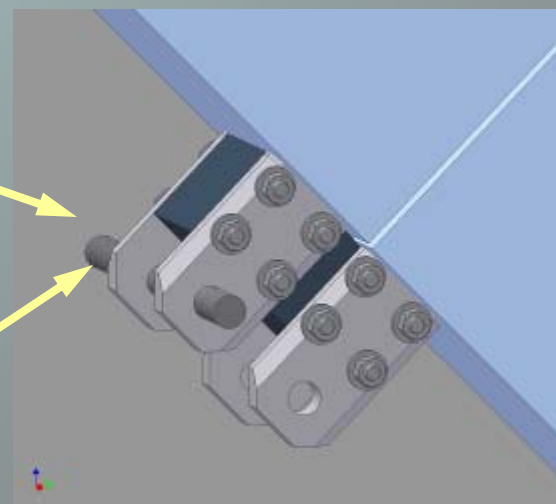
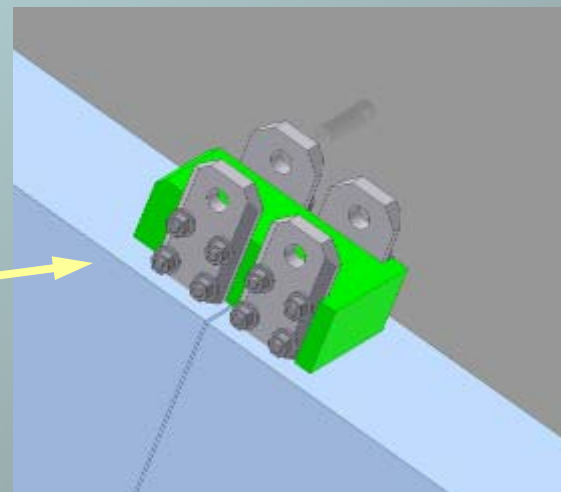
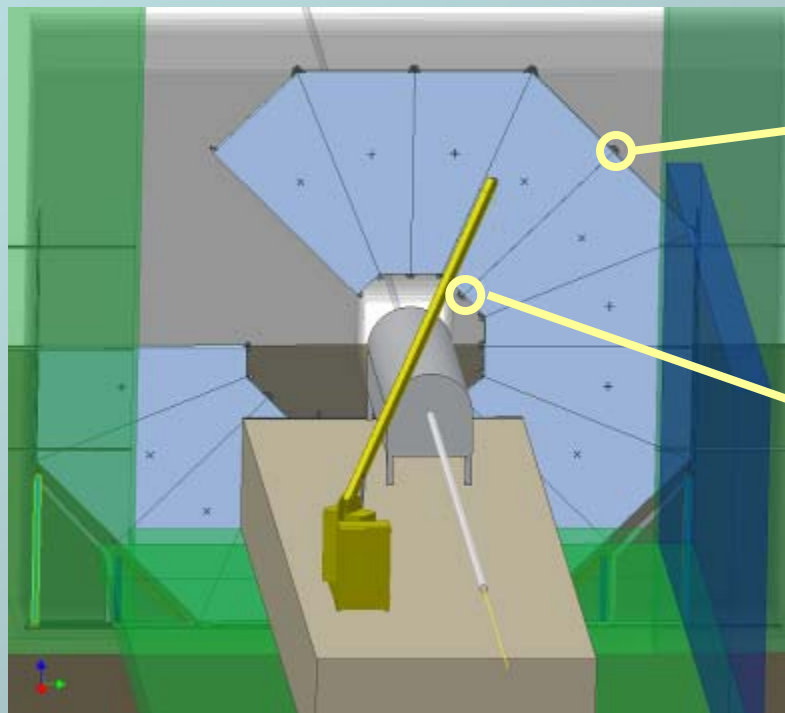
RPC3 North Detector Installation

Half Octant West #6



RPC3 North Detector Installation

Half Octant West #6, cont'd



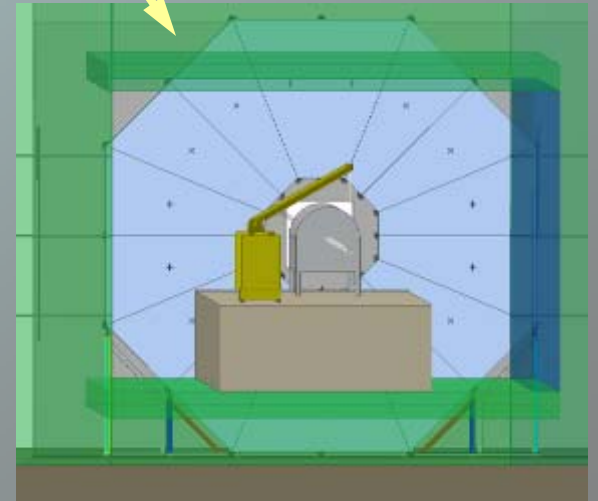
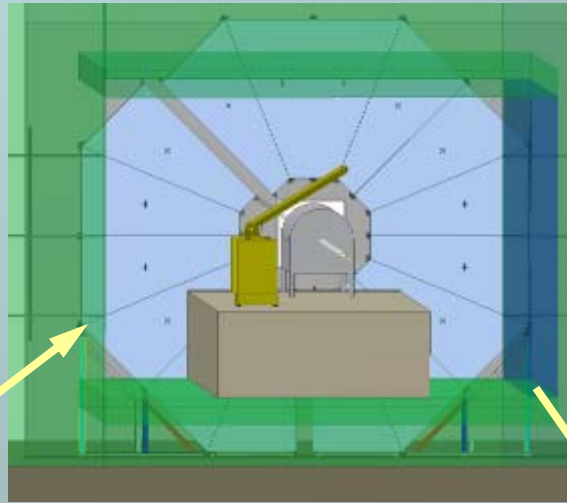
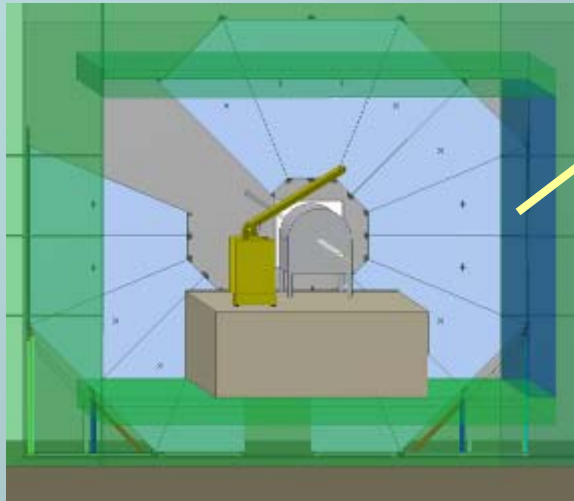
Note: this pin may need to be removed to make height adjustments

RPC3 North Detector Installation

M. Half Octants HO_5 East and HO_6 East are installed similarly to their western counterparts. After these have been installed, the east base is to be mated to the previously mounted HO_7-8 east combination. Height adjustment of the HO_7-8 combination may be required.

RPC3 North Detector Installation

Half Octants East #5 & 6



RPC3 North Detector Installation

4. Electronics and gas system installation

RPC3 North Detector Installation

Gas distribution system to be in-place prior to commencing half-octant installation. As each half octant is installed it will be connected to dry N₂. Final gas and electronics systems for the RPC3 North station shall be installed immediately after half octants have been installed. Detail components shall have been fabricated/purchased prior to completion of half octant installation.

Gas and electrical systems concepts have been reviewed and approved in previous reviews. Any significant deviation from approved plans shall be reviewed by ESRC prior to implementation.

RPC3 North Detector Installation

5. Commissioning

RPC3 North Detector Installation

Commissioning and testing of the RPC3 North station subsystem shall commence as soon as possible after half octants, electronics and gas system have been installed. The commissioning plan will be based on commissioning techniques developed and optimized during the prototype run.

Any open engineering and/or ESRC action item or issue raised in any of the reviews of the RPC3 North station subsystem shall have been fully addressed to the satisfaction of the ESRC prior to commencing commissioning.

RPC3 North Detector Installation

6. Schedule

RPC3 North Detector Installation

- | | |
|--|------------------|
| 1. Installation Concept Finalized | Done |
| 2. Half-Octant Brackets, Connecting Blocks, Base slider/detector translating support design | Done |
| 3. Installation Fixturing and Tooling Design | Done |
| 4. Redesign crystal palace/IR Gas Barrier | Done |
| 5. End of Run 9 | July 6 |
| 6. Fixturing/Tooling, Brackets/Block/support Fabrication | July 7 |
| 7. Move Shielding/Remove Crystal Palace | June 6-July31 |
| 8. Move cable trays and piping in gap 5 | June 6-July 31 |
| 9. Simulated (practice) installation with new fixturing/tooling | July 13-July 31 |
| 10. Install, level & survey support structure | Aug. 3 - Aug 14 |
| 11. Half Octant Testing and Assembly Complete
(1st half Octant ready by Aug.17, 16th by Sep.18) | Aug. 17- Sep. 18 |
| 12. Mechanical Install Align & survey RPC3 N | Aug 17 - Sep. 30 |
| 13. Install 3 elect. Racks, all cables & gas system | Oct. 1 - Oct. 30 |
| 14. Commissioning | Nov. 1 - Nov. 30 |
| 15. Install new crystal palace/IR Gas Barrier & Shielding | Nov. 1 - Nov. 30 |
| 16. Start Run 10 | Dec. 1 |